THE EIGHT-MINUTE ALS RESPONSE TIME STANDARD

Executive Development

The Eight-Minute ALS Response Time Standard:

A Review and Discussion of Its Use as a Strategic Result Goal by the District of Columbia

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CERTIFICATION STATEMENT

I hereby certify that this paper constitutes my own product, that where the language of others is set forth, quotation marks so indicate, and that appropriate credit is given where I have used the language, ideas, expressions, or writings of another.

Signed: _____

ABSTRACT

This project gathered historical and contextual information needed in order to analyze the use of the eight-minute advanced life support (ALS) response time performance standard as a strategic result goal for the DC Fire and Emergency Medical Services Department.

The problem the research attempted to address was that the primary driver of strategic planning for the delivery of pre-hospital emergency medical care in the District of Columbia has been the goal of providing 1st advanced life support response (ALS) to critical medical patients in eight minutes or less, 90% of the time, yet significant dissension existed over whether this goal was appropriate for the city. Senior decision makers urgently needed historical analysis that would allow them to determine if the eight minute ALS response time standard was a valid and useful goal for the District, or if better alternatives existed.

Historical methods were used to attempt to answer five research questions:

1) What is the origin of the 8:00 minute ALS response time standard?
2) How did the DC Fire/EMS Department come to adopt the 8:00 minute standard?
3) Are other jurisdictions using the 8:00 minute standard?
4) What other performance measures are used—locally, regionally, nationally, and internationally—to measure EMS system performance?
5) What does the historical research suggest about the validity and utility of the 8:00 minute standard as a key result goal for the District of Columbia?

The project found that the District of Columbia was an early adopter of the eight-minute ALS response time standard, and that its current use of this performance measure is consistent with industry best practices. The project found that the eight-minute ALS response time standard lacks validity as a clinical performance measure, but that it is useful and appropriate to continue using it as an operational process measure. The researcher recommended that the District of Columbia research and adopt additional EMS quality performance indicators in order to develop a more comprehensive instrument for evaluation of EMS system performance.

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INTRODUCTION

The problem is that the primary driver of strategic planning for the delivery of pre-hospital emergency medical care in the District of Columbia is the goal of providing 1st advanced life support response (ALS) to critical medical patients in eight minutes or less, 90% of the time, yet significant dissension exists over whether this goal is appropriate for the District.

Some stakeholders have argued that the eight-minute standard is not a valid indicator of emergency medical services (EMS) system performance. Some argue that the goal is appropriate, but should be modified or refined. Still others argue that the goal should not be modified at all. The effort to achieve the eight-minute response time target has involved significant fiscal expenditures, controversial redeployment and restructuring decisions, as well as much political turmoil and negative media attention—therefore resolution of this debate is a matter of great urgency to citizens and officials in the District. Senior decision makers urgently need historical analysis that will allow them to determine if the eight minute ALS response time standard is a valid and useful goal for the District, or if better alternatives exist.

The purpose of this research is to provide historical information that will be useful to executive decision makers who are attempting to determine whether responding to 90% of critical medical calls for ALS service in eight minutes or less is a valid and useful strategic result goal for measuring EMS system performance in the District of Columbia.

Historical methods will be used to answer the following research questions:

1) What is the origin of the 8:00 minute ALS response time standard?

2) How did the DC Fire/EMS Department come to adopt the 8:00 minute standard?
3) Are other jurisdictions using the 8:00 minute standard?
4) What other performance measures are used—locally, regionally, nationally, and internationally—to measure EMS system performance?
5) What does the historical research suggest about the validity and utility of the 8:00 minute standard as a key result goal for the District of Columbia?

BACKGROUND AND SIGNIFICANCE

Emergency medical services (EMS) system performance has long been a high-profile issue for the District of Columbia. As early as 1957, the Board of Commissioners of the District of Columbia (the federally-appointed governing body at that time) portrayed ambulance service in the District as unruly and poorly coordinated. At that time there were ten ambulances serving the entire city: four operated by the Fire Department (the first fire department ambulance having been placed in service in 1925); with the remainder distributed between the DC Health Department, Emergency Hospital, Casualty Hospital and Freedmen's Hospital. The ambulances were staffed by a mix of doctors, interns, and first-aid technicians. Units were dispatched by radio and telephone, and a centralized dispatching center had been established by the Fire Department in 1943 (Mould, 1999; Productivity Management Services [PMS], May 1988).

In August 1957, the Board of Commissioners developed and approved a plan to bring all ambulances in the District under the operational control of the Fire Department. Under this plan, the Emergency Ambulance Service was established within the

Firefighting Division of the Fire Department. Ambulances were to be staffed by firefighters and deployed from firehouses (PMS, May 1988).

By the early 1970s, strains were beginning to show in this arrangement, with negative media attention on the quality and efficiency of EMS service, and increasing complaints from firefighters who regarded EMS duty as an undesirable assignment. Eventually, legislation was introduced to form a separate EMS agency. In final form, the legislation kept EMS within the Fire Department, but mandated that the service transition to a "civilian" staffing model. (Note: Firefighters are considered sworn, or "uniformed" personnel; the new members of the Emergency Ambulance Service would be considered civilian or "non-uniformed" personnel, would be trained as EMTs only, and would be subject to a separate pay scale and retirement system from the firefighters.) A primary factor in the drive towards civilianization of the ambulance service appears to have been the expectation that the lower salaries of the new civilian hires would lead to significant cost savings (Mould, 1999; PMS, May 1988).

The first civilian career members of the Emergency Ambulance Service were hired in October 1974, and their numbers grew over the next few years. In the summer of 1976, the District graduated its first class of paramedics, and the first paramedic unit was placed in service in September 1977. By 1981, the Emergency Ambulance Service had become a separate division within the Fire Department, and in 1987 was elevated to the level of a bureau. Also in 1987, the position of director of the Emergency Ambulance Bureau (EAB) was civilianized (Mould, 1999; PMS, May 1988).

Performance problems continued under the new civilianized structure, and periodically media attention and community concerns would erupt over the perception

that an “ambulance crisis” existed in the District. These concerns focused primarily on six issues: long response times, dispatcher errors, ambulance crews unable to navigate the city, allegations of improper medical care, chronic absenteeism and poor morale among EMS workers, and inability to fill paramedic vacancies. These persistent problem issues drove the City Administrator’s productivity unit to conduct nine separate management reform projects involving the Emergency Ambulance Bureau between 1987 and 1995 (Management Engineering and Technology Services [METS], 1996).

One of the early analyses by the Office of the City Administrator (performed in 1989) illustrates the scope of the challenges. Among other findings, the analysts reported that the District of Columbia Emergency Ambulance Bureau had:

- The second-highest per capita EMS call volume of the nation’s 30 largest cities
- Employed nine different directors of the EAB between 1982 and 1989
- Only three advanced life support (ALS) units in service on an average day, due to paramedic shortages and absenteeism
- A 22% chance that no ambulances at all would be available during peak hours
- The worst ambulance “turnout time” in the nation

The District’s internal analysis found that the city was undergoing a steady growth in EMS call volume at a rate of 5.6% annually. The studies found a strong time-of-day pattern in call volume, with incident rates reaching 21 per hour during peak hours, and dropping to 7 per hour at off-peak. Average dispatch-to-scene times for EMS units

during peak hours reached nearly seven minutes, which the study contrasted with a benchmark for "highly regarded ambulance operations" of 3.75 minutes. The researchers found that three factors were most strongly linked to the long response times: lengthy turnout times (1.4 minutes on average, versus a benchmark average of under 30 seconds); poor match between system demand and resource deployment (at that time, the District deployed a constant 21 EMS transport units seven days a week, 24 hours a day, with no variation in deployment based on time or day or day of week); and poor training, motivation and performance by civilian EMS personnel (Productivity Management Services [PMS], June 1987). The analysts found, that if turnout time and deployment stayed constant under the current parameters, that the District would require a fleet of 63 ambulances to meet its response time goals (T. P. Hoey, personal communication, July 29, 2004).

The Productivity Management Services team approached the analysis of EMS system performance in the District as an opportunity to recommend structural changes to the entire service delivery mechanism. The group recruited Jack Stout, an EMS consultant who was strongly identified at the time with system status management (a deployment model) and the public-utility model of EMS. PMS presented city leaders with a choice of system design options, with the public-utility model (PUM) being the recommended option. The American Ambulance Association (AAA) an industry group representing both private sector EMS providers and PUMs, agreed to help fund the implementation of the public utility model in the District as a high-profile demonstration project. Although then-medical director Robert Bass reportedly supported this proposal at the time, the initiative encountered strong opposition from the labor union representing

civilian EMS workers (American Federation of Government Employees, Local 3721 [AFGE]). In a referendum, the civilian EMS workforce overwhelmingly rejected the PUM proposal, with only one member out of the entire workforce of several hundred voting in favor. Frustrated with this resistance, Stout departed the District and the PUM initiative died a natural death. Several of the less controversial reform recommendations of the PMS team, such as navigation training for EMS personnel, were eventually adopted (Hoey, 2004).

Some of the critical EMS issues facing the Fire/EMS Department have improved since the "ambulance crises" of the Eighties and Nineties. The introduction of performance measurement systems and other management reforms to the Public Safety Communications Center has largely eliminated dispatcher errors, with fewer than ten errors being recorded per year. While ambulance crews still occasionally become lost or otherwise delay their responses, the incidence of such events has declined significantly in recent years. Improvements in training and quality assurance have reduced allegations of improper medical care. However three persistent problem areas remain: chronic absenteeism and poor morale among EMS workers, inability to fill paramedic vacancies, and the perception that EMS response times are too long (American Federation of Government Employees, Local 3721 [AFGE], 2003; Office of the Inspector General, 2002; Thompson, 2004; Tri-Data Corporation, 1997).

In response to these persistent problem areas, Fire/EMS Chief Adrian H. Thompson has implemented a linked set of EMS policy initiatives. Although these policy initiatives are strongly identified with the Thompson administration, some were actually developed during the mid-to-late Nineties under the successive administrations

of Chiefs Otis Latin, Donald Edwards, Thomas Tippett, Kenneth Ellerbe, and Ronnie Few. Chief Thompson has taken these initiatives, some of which were unfunded or otherwise dormant, and greatly accelerated their implementation (Few, 2000; District of Columbia Fire and EMS Department, 2004; Office of the Fire Chief, 1996; Office of the Fire/EMS Chief, 2004; Thompson, 2004).

The initiatives include:

- Unification of the workforce. Under this initiative, civilian EMS workers are offered the opportunity to join the uniformed workforce by cross-training as firefighters. This initiative is designed to address morale, recruitment and retention issues by improving compensation and benefits for civilian EMS workers who complete the transition process, as well as improving the District's ability to recruit and retain ALS-certified personnel.

- Paramedic Engine Company Program. This initiative places cross-trained paramedic firefighters on ALS-equipped first-responding fire apparatus, where they can have the greatest impact on ALS response time. Each Paramedic Engine Company placed in service lowers the city-wide average response time by 11 seconds.

- EMT-I Training Program: This initiative seeks to dramatically increase the number of ALS-certified personnel in the workforce by upgrading 40 EMTs and firefighter/EMTs annually to the Intermediate Paramedic level. In addition, the Department proposes training all new entry-level firefighter hires to the EMT-I level at the time of hiring, a practice currently employed successfully by the Dallas Fire Department.

- Modified Staffing Plan: This initiative proposes to convert the District's EMS transport fleet from a two-tiered (BLS/ALS) model to a single-tier all-ALS model, with minimum staffing level of one EMT and one paramedic. A recommendation first proposed in 1998 by the City Administrator's management review team. This initiative is designed to increase the availability and geographic distribution of ALS resources, increasing efficiency while reducing redundant dispatching assignments. (District of Columbia Fire and EMS Department, 2004; Office of the Fire/EMS Chief, 2004; Thompson, 2004).

These initiatives have not been without cost or controversy. All of them are bitterly opposed by the labor union representing civilian EMS workers, which has charged that citizens have died as a result of these initiatives. In testimony presented before the DC City Council on October 16, 2003, the union president stated: "The adoption of [the modified staffing program] has resulted in a marked degradation in the standard of care provided to the recipients of emergency medical services" (Lyons, 2003, p.1). AFGE Local 3721 has further claimed that the Fire/EMS Department leadership is engaged in a conspiracy to suppress unfavorable data on these initiatives.

Some have speculated that the union's opposition to these reform initiatives is primarily political, driven by fear that the Fire/EMS Chief's workforce unification strategy would result in the eventual dissolution of their bargaining unit. Civilian EMS personnel who take advantage of the lateral transfer opportunity to cross-train as firefighters would leave the civilian EMS bargaining unit and enter the uniformed firefighter's bargaining unit, where they would be represented by a different union: Local

36, International Association of Fire Fighters (IAFF). To date, approximately one third of the civilian EMS workforce has applied for the lateral transfer opportunity.

In summer of 2004, DC Councilmember Kevin Chavous introduced Bill 15-387: "The Department of Emergency Medical Services Establishment Act of 2004." This legislation was strongly supported by the EMS union. This bill would remove control of EMS from the Fire/EMS Department, and establish a new cabinet level agency, staffed by civilians, to run the city's EMS system. This bill is strongly opposed by the Executive Office of the Mayor, which argues that it would have a significant fiscal impact, create a redundant layer of bureaucracy, and reduce the efficiency and effectiveness of emergency medical care in the city. Similar legislation was introduced into the City Council in 1999, but defeated.

The issue of response time—specifically that of Advanced Life Support (ALS) response time—is central to this dispute. The primary driver of the Fire/EMS Department's strategic initiatives for improving EMS is the goal of ensuring that 1st ALS resources arrive on the scene of critical medical incidents within eight minutes or less, 90% of the time. This performance goal is embedded in the agency's strategic business plan, performance scorecard, agency director performance contract, and monthly performance report. Public debate over whether the Fire/EMS Department is meeting performance expectations for EMS has largely revolved around this particular performance metric. Therefore, analysis of the appropriateness and validity of this performance goal is of critical importance to key decision makers within the District government, as well as other internal and external stakeholders.

As noted earlier, the debate over the validity of the eight-minute ALS response time goal has become highly politicized, due to the underlying battle over the future direction of EMS in the District. The introduction of the Paramedic Engine Company (PEC) program, for example, has had a clear impact on ALS response time performance. The District has found that staffing first-responding engine companies with cross-trained firefighter/paramedics reduces the citywide average ALS response time by approximately 11 seconds for each PEC placed in service. Those who challenge the validity of the eight-minute response time goal run the risk of being perceived as motivated by a desire to stop the Fire/EMS Chief's unification and cross-training initiatives, while those who champion the eight-minute response time goal are accused of being partisans for the firefighter's union or fire-based EMS. Still others, particularly stakeholders from the public health community, argue that focusing on response time alone ignores critical dimensions of quality of care.

This applied research project attempts to objectively examine the issue of the eight-minute response time standard in order to provide key decision makers with urgently needed historical and contextual information. This research supports the US Fire Administration's operational objective of appropriately responding in a timely manner to emergent issues. This research project is directly linked to the following course content areas of Executive Development (R123):

- Helping EFOs use adaptive leadership principles to manage change
- Helping EFOs seek creative approaches to their work environments
- Providing EFOs with an opportunity to use research to solve real-world problems within their own work environments.

LITERATURE REVIEW

Performance measurement and benchmarking in the public sector

Benchmarking has been defined as the practice of measuring the performance a business unit or organization in comparison to that of other business units or organizations. The benchmarking process enables an organization to examine its performance data within a broader context, and also enables it to define best practices (Hindle, 2000).

The modern benchmarking movement can be traced to the teachings of Americans W. Edwards Deming and J.J. Juran, who sparked the development of total quality management (TQM) techniques in Japan, and later the rest of the world. TQM demanded detailed measurement of industrial activities, which in turn led to the increased use of comparative statistics between competitors. The seminal text *Competitive Advantage*, published in 1985 by Harvard Business School professor Michael Porter, also was influential, inspiring organizations to focus greater attention on external comparisons of performance, rather than internal comparisons against historical baselines (Hindle, 2000).

Performance measurement can be defined as the practice of measuring process parameters and results achieved by a business unit or organization (Moore, 2002). Performance measures can be used as both a management and accountability tool, in order to ensure that resources are being used efficiently and effectively to meet service demands and customer expectations. Modern systems of performance measurement typically capture four domains: outputs, demand, efficiency, and results (outcomes) (Weidner, 2003).

The concept of using standardized performance measures for public sector service delivery in the United States can be documented as early as 1938, when the International City Management Association (ICMA) published its first book on the topic: *Measuring Municipal Activities: A Survey of Suggested Criteria for Appraising Administration* (Hatry, 1996).

The contemporary movement towards performance measurement and benchmarking for public sector services dates to the early 1980's, when public administrators found themselves under growing pressure to justify expenditures in relation to the results achieved. As exemplified in popular texts such as Osborne and Gaebler's *Reinventing Government* (1992) and in legislative initiatives such as the Government Performance and Results Act (GPRA) (1993), public sector agencies became increasingly focused on measuring and reporting performance (Hatry, 1996). The reforms initiated under GPRA have led to similar initiatives at the state and local level, and can be broadly categorized as focusing the attention of government on outputs and outcomes, rather than inputs (Nathan, 2001).

Performance measurement has long been utilized as a management tool in the District of Columbia. In 1967, President Lyndon Baines Johnson reorganized the District of Columbia government (which was under federal control at the time) into a "strong mayor" system, and appointed Walter Washington as the city's first mayor/commissioner. In tandem with this move, the President recruited Tom Fletcher, a pioneering public administrator from San Diego, as city manager/deputy mayor. Fletcher soon instituted a "management indicators system," which included the issuance of a

quarterly management and statistical report (T. P. Hoey, personal communication, July 29, 2004).

Mayor Washington found increasing value in this management report, and in 1970 directed Comer S. Coppie (then Chief Financial Officer for the District) to expand the analysis of city services using scientific management techniques. Coppie was joined in this effort by Thomas P. Hoey, who came to the District in 1970 as an assistant budget director. Hoey's office eventually received a grant from the federal department of Housing and Urban Development to expand the use of productivity and performance management in the District. Hoey helped recruit a team of five academics from the prestigious Carnegie Mellon School of Government Affairs, and by 1973 had launched a formal "performance improvement program" within the District government (Hoey, 2004).

This performance improvement unit was titled Productivity Management Services (PMS) from 1975 to 1994, and Management and Engineering Technology Services (METS) from 1994 to 1995. The unit originally focused on basic operational improvements. Over the years, their projects grew increasingly complex, involving sophisticated computer modeling and work process reengineering tools. Over the course of its existence, PMS/METS completed over 100 management reform projects, and claimed approximately $140M in cost savings or revenue enhancements as a result. The unit was eventually disbanded as a budget-cutting measure during the city's fiscal crisis in the mid-Nineties (METS, 1996; Hoey, 2004).

PMS/METS generally focused its analytical efforts on cabinet-level agencies where management reform held the potential for significant cost savings or performance

improvement. The use of performance measurement and performance reporting as management tools was a constant throughout their existence. In an interview conducted on 7/29/04 with Thomas P. Hoey, one of the founding members of PMS/METS, he notes that performance reporting in the District "started in a very primitive way," by gathering data and setting performance targets for several Mayoral cabinet-level agencies. This effort eventually grew to capture performance data for 75—80 programs spread across 14 agencies. The performance data was collated into a summary report for the mayor and city administrator, and the PMS/METS team performed a quarterly performance briefing for the Mayor with slide show and graphics (Hoey, 2004).

The PMS/METS team was inspired in this effort by the work of John Thomas in the New York City Office of Project Management. His office, which was staffed by expert industrial engineers and project managers, pioneered municipal efforts to reengineer business processes by looking at problem areas. They were among the first municipal groups to make consistent use of performance indicators as a management tool, guided by the principle: "You can't fix what you can't see." The District adopted Thomas' criteria for performance management, and also focused the bulk of their work on measuring and fixing performance in key problem areas (Hoey, 2004).

The District of Columbia won home rule in 1973, and the first elected mayor (Walter Washington, who had previously held the position by federal appointment) took office in 1975. A key component of the transition to home rule was the work of the Congressionally-appointed Commission on the Organization and Efficiency of the District of Columbia Government. This commission, chaired by Ancher Nelsen, conducted an intensive review in 1972 of every aspect of District government structure

and service delivery as a precursor effort to ensure that the city was ready for self-government. When the Home Rule Charter was passed by Congress in 1973, it contained a provision that was inspired by the ongoing work of PMS/METS, requiring that the District government produce an annual performance report capturing the output/efficiency/and effectiveness of city services against performance targets (Hoey, 2004).

Mayor Washington was defeated by Marion Barry in 1981, and Barry conducted a major shake-up of the executive management structure in District government. Barry found less value in performance measurement than his predecessor. Hoey notes: "Mayor Barry was interested in the *politics* of the budget, not the agency performance data." The performance measurement and reporting system was moved to the city's budget office, where it eventually died a "natural death," after a year-and-a-half of neglect (Hoey, 2004).

The staff of PMS/METS was absorbed by new city administrator Elijah Rogers, a product of the prestigious Fells Institute of State and Local Government at Wharton, and one of the "Young Turks" who were then challenging the power structure at the ICMA. Rogers utilized PMS/METS primarily as "turnaround specialists" within the city administrator's office, with a team of 10—12 people (primarily with backgrounds as industrial engineers) performing operational improvement review of troubled programs or agencies. Some use of performance reporting returned in 1983—1984, with the City Administrator's office tracking milestones on key initiatives and approximately eighteen key performance indicators (Hoey, 2004).

The renaissance of performance management in the District of Columbia has occurred since the election of Mayor Anthony A. Williams in 1999. The Harvard and Yale-educated Williams has introduced an array of management reforms and accountability initiatives since taking office. These initiatives include the development of a robust strategic planning and performance management system. The goals driving this system are developed from the ground up, incorporating citizen input from town hall sessions and meetings with neighborhood planners. This input drives the creation of the Citywide Strategic Plan, which establishes broad priorities for city government, as well as the creation of Strategic Neighborhood Action Plans, which focus on service delivery and needs at the neighborhood level. These strategic plans then become the foundation of the city's budget, and are used to align agency goals and key performance measures to the priorities set by residents (District of Columbia Government, 2004).

The District's performance management system develops key result measures for each agency in the city. These measures are specifically linked to objectives contained either in the agency's strategic plan, or in the agency's performance-based budget. Multi-year targets are set for all measures, and the performance information is reported on a monthly basis through the use of performance reports that are distributed internally to the mayor, city administrator, and other key stakeholders. In turn, the performance data is distributed to the public through the annual publication of the Performance Accountability Report & Budget and Financial Plan (District of Columbia Government, 2004).

Table 1 is an example of how a District agency (in this case the Fire/EMS Department), expresses performance data in the agency monthly performance report.

The narrative section allows the agency to place performance information in context, and respond to specific concerns raised by the mayor and other executive users of the report. Note that performance targets are established for the current month, year-to-date, and the end of the year. Actual performance is listed in the row labeled: "actual." Variation from performance against the established target is explained in further detail in the narrative section, which in effect serves as a dialogue around performance issues between the authors of the report (the agency) and the executive users (deputy mayor, city administrator, and mayor).

Table 1: Sample Agency Performance Measure and Narrative From a District of Columbia Agency Monthly Performance Report[1]

Performance Measure 2.4: "Percent of building inspections completed within mandated time frames."

	FY 2002	FY 2003	**January 2004**	FY 2004 YTD	FY 2004 (Year-end)	FY 2005
Target	N/A (new measure in FY 2003)	75% (1,148)	**95% (122)**	95% (488)	95% (1,464 buildings)	95%
Actual	N/A	93% (1,421)	**146% (187)**	126% (647)		

Note: Scorecard Goal 4. This performance measure covers high-priority buildings with explicit inspection criteria: Hospitals, Institutional Care Facilities & Community Residential Facilities (under city regulations such as DCMR 24 and memorandum of understanding between DOH & FEMS); Public schools (annual inspections under Court order); Charter and private schools (voluntary commitment by FEMS); Hotels (annual inspections for Fire Chief's Insignia Award); and Hazardous Materials sites (SARA Tier II).

Agency Commentary for 01/04: There are currently 1,541 buildings with explicit inspection criteria (the number fluctuates each month). The Fire Prevention Division performed 187 inspections of these facilities during January 2004, exceeding the monthly and year-to-date performance targets.

Based on the baseline established in FY 2003 (93%), the agency raised the FY04-06 performance targets from 75% to 95%. Fire Prevention Division inspector staffing has been restored in FY 2004 (some inspectors were redeployed to fire fighting units during FY 20003 as a result of spending pressures), which should allow the Division to achieve the upgraded performance target.

Facility Type	# To Be Insp.	OCT	NOV	DEC	JAN	TOTAL YTD
Hospitals	17	2	2	2	1	7
Nursing Homes	26	2	2	2	1	7
Ambulatory Care Facilities	7	0	1	1	0	2
ICF Mentally Retarded	132	14	18	15	22	69
CRF's 35's Mentally Retarded	34	3	2	6	5	16

Facility Type	# To Be Insp.	OCT	NOV	DEC	JAN	TOTAL YTD
CRF's 34's Elderly	38	6	3	5	2	16
CRF's 38's Mentally Ill	178	22	16	13	18	69
CFSA Foster Group Homes	68	9	11	7	5	32
Day Care Facilities	356	27	29	31	74	161
Penal Institutions	3	0	0	1	0	1
Universities	12	1	1	1	1	4
Hazardous Locations (SARA III)	169	17	12	22	22	73
Service Stations	116	9	14	8	19	50
DC Public Schools	144	8	1	0	0	9
Public Charter Schools	45	0	0	0	17	17
Private Schools	83	1	0	0	0	1
Hotels	113	40	36	37	0	113
TOTAL	**1541**	**161**	**148**	**151**	**187**	**647**
CFSA Foster Care Homes	TBD	18	46	49	36	149

[1] Table by author, reprinted from the January 2004 FEMS Agency Monthly Performance Report

In addition to the annual performance plan and budget documents, The District utilizes agency director scorecards, which contain summary information on certain key measures and are posted quarterly on wall posters and the District's website. The performance measures for each agency are also contained in each agency director's performance contract, creating explicit consequences for failure to meet or exceed performance expectations. Finally, the agency goals and performance measures are incorporated directly into the budgeting development and planning process. This is known as performance-based budgeting (PBB), a process that directly links expenditures to the programs and activities they support (Weidner, 2003; District of Columbia Government, 2004).

The District of Columbia's current strategic planning, budgeting, and performance management structure can be summarized as a "managing for results" system, and as such is regarded as a best practice in municipal management by external

bodies such as the Government Finance Officers Association (GFAO) and the Governmental Accounting Standards Board (GASB) (Weidner, 2003).

Performance measurement, benchmarking, and standards for fire and emergency medical services

Performance standards use clear language and explicit criteria to establish benchmarks for structures, processes, or results in a given industry. Performance standards can be mandatory (regulatory in nature) or voluntary. Voluntary standards are typically established by consensus, and can become mandatory if they are adopted as regulations by a government or industry (Moore, 2002).

There are a variety of stakeholder groups in the United States at the national level with an interest in developing or validating performance measures or standards for the fire and emergency medical services. These groups include the National Highway Transportation Safety Administration (NHTSA), International City/County Management Association (ICMA), Commission on Fire Accreditation International (CFAI), National Fire Protection Association (NFPA), International Association of Fire Fighters (IAFF), International Association of Fire Chiefs (IAFC), American Ambulance Association (AAA), Commission for Accreditation of Ambulance Services (CAAS), International Fire Service Accreditation Congress (IFSAC), National Board on Fire Service Professional Qualifications (NBFSPQ), American Society for Testing and Materials (ASTM), Joint Commission on Accreditation of Healthcare Organizations (JCAHO), Committee on the Accreditation of Allied Health Education Programs (CAAHEP), Commission on Accreditation for Law Enforcement Agencies (CALEA), Fire Department Safety Officers Association (FDSOA), National Association of EMS

Physicians (NAEMSP), and the Insurance Services Office (ISO) (Evans, 2001; Moore, 2002).

In addition to organizations at the national level, there are many state and local groups with an interest in developing or validating performance measures or standards for the fire and emergency medical services. Examples of these stakeholders include organizations such as the Maryland Institute for Emergency Medical Services Systems (MIEMSS), the California Emergency Medical Services Authority (CEMSA), and the Emergency Medical Services Administrator's Association of California (EMSAAC) (Moore, 2002; Sobo, Andriese, Stroup, Morgan, and Kurtin, 2001).

Although standards for the fire service have existed for decades, typified by the National Fire Protection Association's many standards for fire protection and life safety systems, efforts to develop valid standardized performance measures and standards for delivery of EMS have been somewhat slower. As an example: the landmark text: "How Effective Are Your Community Services? Procedures for Measuring Their Quality" by Harry P. Hatry, et al., originally published in 1977, and reissued in a 2nd edition in 1992, provides hundreds of suggested performance measures covering ten major areas of government services, including public safety. Although 23 measures are given for measuring fire service effectiveness, none are related to emergency medical services.

Dr. Lori Moore (2002) notes:

> To date, universal indicators of quality performance in EMS systems have neither been identified nor defined. Performance measures have not been developed and field-tested. There is no validated system [of] performance measurement through which to assess the quality and effectiveness of EMS systems. (p. 14)

Moore (2002) adapts the work of Jerry L. Harbour (author of "The Basics of Performance Measurement," published in 1997) to define the expected benefits of a performance measurement system for EMS:

1. Ability to perform continuous quality measurement in a system
2. Ability to recognize and highlight areas of high performance
3. Ability to recognize and highlight sentinel events (an undesirable event that should trigger further analysis and investigation)
4. Ability to measure the effectiveness of corrective action or reform initiatives
5. Ability to perform benchmarking or other comparisons to recognized standards

In 1997, the National Highway Transportation Safety Administration (NHTSA) published the "Leadership Guide to Quality Improvement for Emergency Medical Services (EMS) Systems." This guiding document, utilizing the basic format of the Malcolm Baldridge Quality Categories, is intended to serve as a template for continuous quality monitoring and improvement in EMS systems. The guide illustrates some potential indicators of EMS system performance, but does not create explicit operational criteria (Moore, 2002; National Highway Transportation Safety Administration, 1997).

A convenience sample was taken in February 2004 of all Executive Fire Officer Program applied research projects meeting the criteria for collection by the National Fire Academy's Learning Resource Center with the key words "response time," "performance measures," "performance management," and "benchmarking," contained in the title or abstract. This sample revealed that all of the authors found value in the concept of performance measurement and the use of standardized performance criteria for the fire

and EMS service. Most of the authors, however, noted either the absence or poor utilization of valid, reliable, and standardized performance measures (both locally and nationally) for measuring fire and EMS service outcomes, efficiency, and effectiveness. Most of the authors also found deficiencies or gaps in the existing local and national attempts to create sets of standardized performance measures (Andrus, 2000; Bowman, 2002; Castillo, 2002; Herald, 2000; Ray, 2000; Stauber, 2003; Trevino, 1996; Wilbur, 1998; Young, 2002).

Moore (2004) believes that it will be another five to seven years before there is a fully accepted standardized set of performance measures for the fire and EMS service. Moore's 2002 doctoral dissertation: *Quality Performance Measures for Prehospital EMS Systems: Instrument Reliability Test*, describes an effort—jointly endorsed by the International Association of Fire Fighters (IAFF) and the International Association of Fire Chiefs (IAFC)—to develop a standardized set of quality indicators for evaluating EMS system performance. This set is titled the *IAFF/IAFC EMS System Performance Measure Instrument*.

Response time as a performance measure

An early text outlining procedures for measuring government services, "Improving Productivity Using Work Measurement: a Management Report and Technical Guide for State and Local Governments," prepared in 1977 by Public Technology Inc., notes that "The primary criterion for responsiveness of emergency services is response time—the elapsed time from receipt of a call for service until the arrival of the appropriate service unit" (p. 102). The authors describe three general approaches to measuring response time performance: average value of response time;

percent of responses within a defined time limit; and equalization of average response times across defined geographical or administrative service areas.

In 1987, a survey of EMS systems in the thirty largest U.S. cities found that there were no standardized criteria for the calculation of EMS response time (Productivity Management Systems, 1987).

In his seminal JEMS 1987 article "Measuring Response Time Performance," EMS consultant Jack Stout wrote:

> From the patient's point of view, ambulance response time can only be defined as the interval between the moment callback number, location, and chief complaint are first made known to the 9-1-1 center and the moment the first ambulance unit arrives at the scene. (p. 107)

Since Stout and others first drew attention to the problem, significant work has been performed at the national level to achieve a consensus definition of response time. The current generally accepted definition of response time for the fire and emergency medical services is: the time elapsing from receipt of an emergency call at a public safety answering point (PSAP) until arrival on the scene by responding emergency vehicles. This elapsed period of time contains sub-components (or "intervals") that can include call processing time, turnout time (the time from dispatch of a call until "wheels are rolling"), and travel time (Moore, 2002).

While some consensus has been reached on defining the components of response time, wide variations persist in how different jurisdictions calculate and report response time statistics. Braun (1993) notes that a national survey of EMS systems performed by

Dr. Richard O. Cummins in 1991 found varying definitions of response time segments, with about half the systems starting the response time clock at receipt-of-call, and half at receipt-of-dispatch. A series of analyses conducted between 1987 and 1995 by the District of Columbia's Productivity Management Services found similar variations in calculation and reporting of response time performance by different municipalities (METS, 1996). In the First National EMS Systems Survey conducted by Emergency Medical Services Magazine in 2003, 45% of responding agencies started their response time clocks at the time of dispatch, while most of the remainder (approx. 47%) started the clock during some earlier phase of the call receiving process. 4% started the clock at the end of the turnout time interval, when "wheels were rolling."

Not all agree that calculation of response time should begin with receipt of an emergency call for assistance. Zikmund (2000, 2001) contrasts the standard fire service definition of response time with that of some medical researchers, who define response time as the total time from occurrence of an incident (i.e. onset of cardiac symptoms) until initiation of treatment by an appropriate responder. He suggests that the medically driven definition of response time may be more appropriate for both fire and EMS calls, because even fire suppression incidents contain time delays for recognition of an event, notification of authorities, and time between arrival and application of an extinguishing agent.

Another key issue in the use of response time as a performance measure is the question of how the statistic should be expressed: as an average (mean) or as a fractile calculation (in which all response are placed in a frequency distribution, and performance is examined at various designated points, such as the percentage of all calls within eight

minutes or less). Industry consensus seems to be that fractile expression of the statistic is the preferred method. Overton & Stout (2002) trenchantly state: “Average response time is not only a totally misleading indicator of response-time reliability, but it is also a clinically inappropriate goal” (p. 122). They note that systems with similar average response times can deliver widely varying levels of clinical performance to their patients when analyzed using fractile comparisons. This opinion is shared by Zikmund (2000) and many others. It is interesting, however, to note that of the agencies that responded to the First National EMS Systems Survey conducted by Emergency Medical Services Magazine in 2003, only approximately 3% reported using fractile calculation of response time. This suggests that actual use of fractile response time measurement is still not widespread.

Overton & Stout (2002) recommend that response times be subdivided into smaller response intervals in order to perform effective EMS system analysis. When response times are divided into specific segments, it then becomes easier to focus reform efforts on areas with the greatest potential for influencing operational and clinical outcomes. They cite reducing the “call-to-dispatch” and “dispatch-to-en route” intervals as two interventions with a high potential for improving system performance. They note that travel time is less appropriate as a target for reduction, because of the risk of increasing emergency vehicle accidents.

Overton & Stout (2002) note that any EMS system has certain factors that will place hard limits on response time performance at a given funding level. Among these factors are: traffic, availability of mutual aid, hospital location, size and configuration of service area, quality of road network, and size and variance of population. While these

factors may set a ceiling on the maximum productivity level possible in a given EMS system, Overton & Stout believe that the three most critical factors driving response time performance and reliability are: ability to understand and predict call volume, based on time of day and day of week; ability to understand and predict geographical location of calls; and ability to use statistical tools to strategically locate EMS resources for maximum effectiveness, based on the two factors above.

The analysis of Mayer (1979) illustrates the paradox of response time as a factor in planning or evaluating EMS systems. He notes that most EMS planning operates under the blanket assumption that clinical outcomes are dependent on rapid ambulance response times, and that the quicker an ambulance arrives, the better the chance of survival for the patient. However he finds a significant absence of clinical research to support this assumption. He also notes that research suggests that marginal costs for adding additional ambulances to a system significantly exceed marginal response time reductions after a certain point.

Mayer goes on to note that there are significant delay factors affecting clinical outcome exclusive of response times. He summarizes these other factors as: 1) delay between onset of an emergency and recognition of symptoms; 2) delay between recognition of symptoms and deciding to seek help; 3) delay in contacting EMS and processing the service request; 4) delay at the scene of the emergency; & 5) transport time. Mayer cites various studies to support his contention that of the many factors affecting patient outcome, particularly in cardiac cases, the interval between onset of symptoms and deciding to seek help (which he calls “decision time”) appears to be the most clinically significant. He reports that this interval accounted for 65% of the delay to

definitive care in a Rochester, NY study, and that only 40% of cardiac patients in a Cleveland study chose to seek medical care within two hours of symptom onset. Mayer concludes: “In major metropolitan areas with effective EMS systems, more attention should be devoted to education and the diffusion information than to the acquisition of additional emergency units to further minimize already low response times” (p. 826—827).

In a landmark 1991 study of Chicago’s EMS service, Becker, Ostrander, and Barrett found that the average time between arrival of paramedics on the scene and delivery of first shock to patients in fibrillation was eight minutes. Sayre, Swor, Pepe, & Overton (2002) note that even assuming that an emergency event is promptly recognized and resources are promptly dispatched—two strategic issues that EMS systems have spent years addressing—providers still face significant challenges in reaching a patient’s side in time to initiate critical medical interventions. The work of Campbell, Gratton, Salamone, & Watson (1992; 1993), reinforces this point, finding that the time to reach a patient’s side and initiate care is a significant and under-reported component of true response time.

Hedges (1993) notes the importance of establishing standardized definitions of time of arrival in order for multi-source EMS research studies in order to produce valid results.

Bailey & Sweeney (2003), in a position statement adopted by the National Association of EMS Physicians, advocate the following principles:

- Response time should be defined as call-to-dispatch

- Fractile response intervals should be used to calculate EMS system performance, not averages
- Medical directors should lead the setting of response time performance standards
- Response time standards should be developed using a community-based consensus approach, and different communities may establish different targets form acceptable system performance, based on their resources and attributes.

The Commission on Accreditation of Ambulance Services (CAAS) also recommends that EMS medical directors play an active role in setting response time requirements for their systems (Hogue, 2001).

In the most recent edition (2002) of the National Association of EMS Physicians (NAEMSP) textbook "Prehospital Systems and Medical Oversight," Overton & Stout note that although fractile measurement of response time equalizes reliability across an entire service area, specific geographic areas may still be subject to performance gaps. They recommend that agencies also measure response time within geographic sub-zones to ensure that no neighborhood is underserved.

The eight-minute standard for response time

Efforts to establish standardized performance expectations for EMS response time can be traced back as far as the Emergency Medical Services Systems Act of 1973 (amended in 1976), which directed that 95% of all requests for emergency medical

service should be met within 30 minutes in rural areas, and within 10 minutes in urban areas (Mayer, 1979).

The 1993 edition of the "Standards for the Accreditation of Emergency Ambulance Services," issued by the Commission on Accreditation of Ambulance Services (CAAS), lists 55 standards for EMS systems, of which only one directly addresses system performance expectations for response time. The CAAS standard for response times (201.05) reads:

> It is recommended that the local response time standards be aligned with the clinically determined optimal response time standard of eight minutes, which when calculated to the second shall not exceed eight minutes and fifty-nine seconds (0:08:59). This standard applies to systems where first responder services are also in place and should be maintained with a high degree of reliability… Response times shall be calculated by computing the difference in time from where the location of the patient, the call-back number of the calling party and probable complaint are known (if possible) until the time when an appropriate responding crew advises they have arrived at the scene. (p. 8)

The concept of the eight-minute standard for response to critical medical calls was first broadly promulgated in the fire and EMS service by the American Heart Association (AHA), which establishes the guidelines for Advanced Cardiac Life Support (ACLS) and publishes the associated textbook. The 1987 edition of the ACLS textbook cited the late 1970s/early 1980s research of Dr. Mickey Eisenberg in King County, Washington to support the following position: "To maximize chances of survival, the delay from onset

of cardiac arrest until CPR and definitive care [defibrillation/ACLS] should be kept as short as possible, ideally to 4 and 8 minutes, respectively" (p.4).

Interestingly, although Eisenberg et al.'s research showed a clinical correlation between early defibrillation and survival from out-of-hospital cardiac arrest, the response time intervals and the eight minute standard were not explicitly identified or defined in the early literature (Cobb, Werner & Trobaugh, 1980; Eisenberg, Bergner & Hallstrom,1980; Weaver, et al. 1986). In 1990, Eisenberg, Horwood, Cummins, Reynolds-Haertle, & Hearne performed a meta-analysis of 34 published studies on survival rates for out-of-hospital cardiac arrest: *Cardiac arrest and resuscitation: a tale of 29 cities.* The 34 studies reviewed in this analysis were dispersed among eight countries and 39 EMS programs, and used widely varying population inclusion sets and definitions of response time intervals. Eisenberg's meta-analysis extrapolated a hypothetical survival curve for a jurisdiction capable of providing ALS to victims of out-of-hospital cardiac arrest. This curve displayed a sharp change in the survival slope at an average response time of eight minutes for an ALS equipped system, however the response time intervals were not explicitly defined in the analysis.

The AHA recommendations were eventually adopted by the National Fire Protection Association (NFPA) during the development of NFPA 1710: *Standard for the Organization and deployment of Fire Suppression Operations, Emergency Medical Operations, and Special Operations to the Public by Career Fire Departments*. The initial draft of NFPA 1710 (2001 edition) set a benchmark of eight minutes, 59 seconds or less for arrival of ALS resources at an emergency medical incident. The NFPA 1710 (2001 Edition) as finally adopted, now states:

[Section] 4.1.2.1.1 The fire department shall establish the following time objectives:

1) one minute (60 seconds) for turnout time…

3) four minutes (240 seconds) or less for the arrival of a unit with first responder or higher level capability at an emergency incident

4) eight minutes (480 seconds) or less for the arrival of an advanced life support unit at an emergency medical incident, where this service is provided by the fire department

4.1.2.1.2 The fire department shall establish a performance objective of not less than 90 percent for the achievement of each response time objective specified in 4.1.2.1.1. (p. 6)

NFPA Standard 1710 (2001 edition) also provides the following definition of response time as an interval distinct from call processing time and turnout time: "[Response time is] the time that begins when units are en route emergency incident and ends when units arrive at the scene" (p. 6).

The IAFF/IAFC *EMS System Performance Measurement Instrument* (2002) performance standard for response time mirrors that of NFPA 1710: Percentage of all EMS calls achieving ALS unit travel times of 8 minutes 0 seconds or less. The target goal is 90%. Response time is defined as the time elapsed from vehicle wheels turning to arrival of vehicle at the address.

Eckstein & Pratt (2002), writing in the 3rd edition of the NAEMSP's text: *Prehospital Systems and Medical Oversight*, note that the eight-minute response time

standard has strengthened the argument for fire-based EMS as a system model. Because most fire departments are already required to meet response time and geographic coverage goals for responding to structure fires, their infrastructure and response assets are uniquely positioned to provide rapid response to critical medical emergencies in a timely fashion.

Although a study by Bossaert in 1991 found that systematic gathering and reporting of performance data by European EMS systems was still rare, some examples of differing approaches to response time standards can be found overseas. In the United Kingdom, for example, a 1996 review by the National Health Service led to EMS calls being grouped into three categories: A) Immediately Life Threatening (i.e. cardiac arrest); B) Serious (i.e. major fractures); and C) Neither Life Threatening Nor Serious. The Department of Health is in the process of implementing new response time standards correlated to these patient categories (Murray, 2000).

Prior to 1996, the national response time standard in the U.K. for all emergencies was arrival of EMS:

- Within less than nine minutes, 50% of the time
- Within less than 15 minutes, 95% of the time, in urban areas
- Within less than 20 minutes, 95% of the time, in rural areas

Between 1996 and 2000, the national response time standard in the U.K. for all emergencies was arrival of EMS:

- Within less than eight minutes, 50% of the time
- Within less than 14 minutes, 95% of the time, in urban areas

- Within less than 19 minutes, 95% of the time, in rural areas

The new national response time standard in the U.K (effective January 2001) is:

- For category A events, arrival of EMS within less than eight minutes, 75% of the time, regardless of geographical area
- For category B & C events, arrival of EMS within less than eight minutes, 50% of the time, regardless of geographical area
- For category B & C events, arrival of EMS within less than 14 minutes, 95% of the time, in urban areas
- For category B & C events, arrival of EMS within less than 19 minutes, 95% of the time, in rural areas (Murray, 2000).

In addition to these new response time standards for the UK, additional National Health Service pilot projects are underway to develop alternatives to emergency transport for Category C patients (Murray, 2000). Woollard (2002) proposes that this effort to develop non-emergency transport modalities for Category C patients may improve response times for those patients with truly time-critical conditions, however he cautions that further research will be needed to validate this hypothesis.

Limitations of the eight-minute response time standard

Bailey & Sweeney (2003) succinctly note that: “Except for cardiac arrest, there is little or no scientific evidence suggesting a causal relationship between response interval and improved patient outcomes” (p. 397). They go on to note, however, that there remains a public expectation that EMS should be provided in a timely manner, regardless of medical complaint. They hold out the possibility that different communities may

establish differing expectations of timely service, based on population density and other characteristics.

Pons & Markovchick (2002) note: “justification of specific [response] time criteria for specific medical or traumatic emergencies is lacking” (p. 44). They conducted a retrospective analysis of two year’s worth of trauma data from the busy Level I trauma center at Denver Health Medical Center, and found that ambulance response time has no effect on survival for critical trauma patients who are transported by EMS to a trauma center. In a similar finding Pepe (1998) found no correlation between increased pre-hospital times and mortality in hypotensive victims of penetrating trauma. Pons & Markovchick also cite the 1995 work of Jones, which found no relationship between EMS response time and mortality in victims of traffic accidents. They conclude that “factors other than ambulance response time” are driving patient outcomes (p. 47).

Pons & Markovchick (2002) express concern that the eight-minute standard for all EMS responses was established based upon the delivery of one specific clinical intervention (defibrillation). They note that defibrillation can now be delivered from a variety of platforms other than traditional EMS units. Observing that there is a considerable financial cost associated with reducing response times, they suggest that the continued use of the eight-minute ambulance response time criteria may no longer be appropriate for EMS systems.

Dr. Lori Lynn Moore, of the International Association of Fire Fighters, discussed EMS performance measures with the author in an interview conducted on July 26, 2004. She noted that there is “little science” behind the eight-minute response time standard, although she believes that the original cardiac arrest research by Eisenberg, Braun and

others is clinically valid "under the assumptions of those particular studies." Moore distinguishes between clinical performance and system performance. She defines the eight-minute response time standard as a system performance measure, not a clinical one. She notes, however, that there is an important relationship between system measures and clinical measures, in that system performance impacts clinical performance. While acknowledging that cardiac arrests comprise three percent or less of the EMS call volume nationally, she states: "If we perform [well] there, then it's very likely that we are performing well on other calls."

In an interview conducted by the author on July 27, 2004, Jerry Overton, Executive Director of the Richmond Ambulance Authority, reinforces this point, noting: "Time-to-shock was originally a clinical standard, but has evolved into an operational standard. Clearly, time is associated with outcome in cardiac arrest, although interestingly, eight minutes has never been defined in the literature. In fact new articles suggest that six minutes might be the more appropriate clinical interval. In EMS, we should be accountable for response time, although there are a tremendous number of intervening variables that may keep us from reaching the patient's side within eight minutes. Nevertheless, regardless of its clinical validity for all medical calls, the eight minute standard is very important from an operational perspective as an accountability measure."

Johnson (1991) notes:

> Most prehospital interventions, both pharmacologic and procedural, have been accepted without clear demonstrations of their abilities to impact patient outcomes or without clear indications that withholding or delaying the intervention pending

> arrival at a definitive emergency department will adversely affect the patient. (p. 426)

Pepe (1993) also found that research was not being fully utilized to validate EMS delivery decisions, stating:

> Although resuscitation research was the original basis of EMS, the critical premise of establishing scientific investigations to improve patient care was soon misplaced. The focuses of most EMS programs have become response times, procurement of equipment, certification of EMS personnel, and "protocol" development. Ironically, there have been very few controlled trials to validate the many treatment protocols that EMS systems now offer. (p. 18)

Lerner, Billittier, Moscati, & Adolf (2002) note that while studies of first-responder defibrillation programs have shown that time to first shock can be reduced through use of Automatic External Defibrillators (AEDs) by firefighters, police officers and EMTs, a definitive improvement in survival to hospital discharge has not been conclusively demonstrated.

Another limitation of eight-minute response time standard is that it may never be achievable in certain geographic areas of the country. For example, a survey of 152 rural EMS systems conducted in 1988 found that 39% of the systems sampled reported average EMS response times greater than eight minutes, and of these, 7% reported average response times greater than fifteen minutes (Foulk, 1989).

Another issue involving the eight-minute response time standard is the lack of comparative performance data for benchmarking. National surveys suggest that most

EMS systems are not performing fractile calculations of their response time data (Emergency Medical Services, 2003). The nation's largest set of comparative performance measurement data for the public sector is the International City/County Management Association Center for Performance Measurement's *Comparative Performance Data Report*. The FY 2001 *Report* contained data from 77 jurisdictions, reporting thousands of data points related to public safety and other areas of public sector performance, however none were queried on fractile EMS response time performance. All EMS response time data were expressed in averages (ICMA, 2002).

Response time as a performance measure in the District of Columbia

The eight-minute response time standard, expressed as a fractile statistic, was introduced to the District of Columbia in 1987 by Productivity Management Services (PMS), the internal management consulting arm of the Office of the City Administrator. PMS was inspired in this effort by EMS consultant Jack Stout, who was brought into the project team as a subject matter expert on EMS system design. Between 1987 and 1995, PMS performed nine separate evaluation and reengineering projects involving EMS, in response to recurring concerns that an "ambulance crisis" existed in the District. PMS's initial 1987 evaluation of DC EMS made the following recommendation:

> Ambulance performance measures should be changed to include the probability of a first responder arriving at scene within 4 minutes, and the probability of a paramedic arriving within 8 minutes. The above probabilities should be above 90% for satisfactory performance. (PMS, 1987)

In the mid-1990s the District of Columbia entered a period of fiscal crisis, leading to the establishment of a federally appointed "Control Board" to manage the District

government. This body, known formally as the District of Columbia Financial Responsibility and Management Assistance Authority, chartered a series of consultant's reports analyzing every area of District government operations. Several of these studies addressed the Fire and Emergency Medical Services Department. A June 1997 report by the firm of Deloitte & Touche, LLP, provided a set of recommended performance measures for the Fire Department, including eight EMS "outcome/effectiveness measures": percent of BLS responses within four minutes; percent of ALS responses within eight minutes; average BLS response time; average ALS response time; average patient-to-hospital time; cardiac success rate; medical protocol compliance rate; & EMS injury rate. With the exception of the response time information, which the Department was already tracking, these EMS measures were not adopted (Delloitte & Touche, 1997).

It is interesting to note that at the time of the 1997 Delloitte & Touche study, the Department's ALS response time performance standard was set at "less than nine minutes," and paramedics were arriving on the scene within this target only 37% of the time (measured call-to-scene). The average ALS response time (call-to-scene) was approximately 12:30. The bulk of the Department's existing EMS performance measures were output measures: total responses (ALS & BLS); total transports (ALS & BLS), and total incidents (Delloitte & Touche, 1997).

In July 2001, an internal "EMS Response Time Committee"—made up of stakeholders from the Fire/EMS Department, Executive Office of the Mayor, and the Mayor's EMS Advisory Committee—began meeting regularly to analyze the Department's response time performance. This group found wide variations in the methodologies that different jurisdictions were using to define response time. This

created a problem because the performance of the DC Fire/EMS Department was sometimes being benchmarked against the performance of agencies with less stringent definitions of response time—leading to "apples and oranges" comparisons. The Response Time Committee created a data dictionary defining the discrete data points necessary to calculate various response time intervals. The Committee also recommended that the District calculate response time as "dispatch-to-scene," expressed as a fractile measurement, in order to align with national best practices and allow for more accurate benchmarking comparisons. The Committee further clarified that the eight-minute response time standard should be defined as arrival on the scene of the first ALS-equipped resource, for critical medical calls, i.e. calls that were coded as "Charlie" or "Delta" dispatches under the Medical Priority Dispatch System (MPDS). These recommendations were subsequently incorporated into the agency's strategic business plan and monthly performance report (District of Columbia Fire and Emergency Medical Services Department Response Time Committee, 2001).

Some key stakeholders in the District of Columbia find limitations and flaws in the current utilization of the eight-minute response time standard. The author interviewed Dr. Fernando Daniels III, medical director for DC Fire/EMS from 1999 to 2004. (Note: Dr. Daniels left District government service in September 2004, shortly after this interview was conducted. His successor as medical director is Dr. Clifford H. Turen.) Daniels notes that cardiac arrests comprise only one to three percent of EMS calls in the District of Columbia. He reports that the DC Fire & EMS Department encounters fewer than 400 cardiac arrest patients per year with the potential for resuscitation, less than 1% of its total patient call volume. Daniels believes that eight

minutes is an appropriate response time standard for certain critical medical emergencies, such as cardiac arrest and status asthmaticus, but that it should not be used for all medical emergencies. Daniels reports that he estimates that only five to seven percent of the District's current critical medical dispatches (those coded Charlie or Delta in the Priority Medical Dispatch System) truly need an eight-minute response. He also believes that 85 to 90% of all medical calls in the District can be effectively handled by basic EMTs trained to DC's new advanced scope of practice protocol, which allows them to start IV's; administer fluids; perform blind intubations utilizing the Combitube ® airway; and deliver Narcan ®, sublingual nitro, and nebulized albuterol.

Daniels notes the criticism the District of Columbia and other jurisdictions have faced for their inability to capture EMS performance indicators such as "time-to-shock" and patient outcome data after transfer of care to hospital staff. Daniels notes that one of the challenges the District has faced in measuring the defibrillation component of response time is the technical inability to capture the time of first shock. Even attempts to retrospectively capture time of first shock by downloading and transcribing AED data have failed, because there is no reliable method of calibrating the internal clocks on the AEDs to the time stamp in the computer-aided dispatch (CAD) system that is used to measure response time. Daniels also notes that HIPAA regulations create a formidable challenge to EMS systems attempting to track patient outcomes through discharge from the hospital (F. Daniels, personal communication, July 29, 2004).

EMS performance measures other than response time

The national blueprint: "EMS Agenda for the Future," issued in August 1996 by the National Highway Traffic Safety Administration (NHTSA) and the Health Resources

& Services Administration (HRSA), establishes a vision of EMS as the "linchpin" joining the currently isolated public safety, health care, and public health systems. In this vision, EMS functions as community-based health management system, with the responsibility for surveillance, identification, intervention, and evaluation of injury and disease (Martinez, 1998).

The Joint Commission on Accreditation of Hospital Organizations (JCAHO) defines the following dimensions of performance for health-care systems: efficacy, effectiveness, availability, timeliness, appropriateness, continuity, safety, efficiency, and respect. (Dunford, et al., 2002)

Dunford, et al. (2002) identify three elements traditionally used to measure EMS system performance: structure, process, and outcome. National Highway Traffic Safety Administration utilizes a similar set of categories: input, process, and outcome (NHTSA, 1997).

Birnbaum (1999) finds fault with the current state of EMS performance measures, noting that EMS systems are still largely evaluated based on cardiac arrest outcomes. He notes that EMS systems treat a much broader patient population that just victims of sudden death, and advocates for greater development of outcome measures for other conditions—as well as efficiency, effectiveness, and cost/benefit measures. The National Highway Traffic Safety Administration (NHTSA) has made similar findings. Noting that cardiac arrests constitute only a small portion of the care provided by an EMS system, NHTSA recommends that outcome measures for EMS encompass the "Five D's": death (survival); disability; discomfort; dissatisfaction; and destitution (cost efficiency).

NHTSA also notes that appropriateness and efficiency of care delivery are important elements to examine (NHTSA, 1997).

The internationally-based Task Force on Quality Control of Disaster Management (TFQCDM) finds that there is no universally accepted methodology for measurement of EMS system performance in another critical domain: that of disaster medical response (TFQCDM, 1999).

Hedges (1993) recommends that EMS systems move away from binary EMS outcome measures (i.e. pulseless vs. non-pulseless) and towards more nuanced quality-of-life measures such as cerebral performance after resuscitation, years of added survival, and years of additional employability. Hedges also advocates that systems perform valid cost-effectiveness analyses, taking into account the actual costs required to achieve these outcomes.

In California, the state began a demonstration project in 1998 to develop standards and guidelines for statewide EMS system continuous quality improvement. This project was eventually combined with a parallel effort to develop a statewide EMS evaluation instrument. The combined project team developed a set of approximately 25 EMS quality indicators. This set included items such as:

- Percent of critical trauma patients with scene times of 10 minutes or less
- Percent of patients in respiratory distress who receive oxygen
- Percent of cardiac-involved chest pain patients receiving aspirin, nitroglycerin, and/or morphine
- Percent of successful endotracheal intubations & intravenous cannulations

- Percent of trauma patients transported to a designated trauma center
- Percent of cardiac arrest patients discharged from hospital alive
- The set also included response time measures for call processing and call-to-scene (Sobo et al., 2001).

Overton (2004) notes that some public utility model providers are exploring system status plans designed for specific disease modalities.

The District of Columbia Fire/EMS Department's medical director Dr. Fernando Daniels proposes the following new measures: "percent of true ALS calls that actually receive ALS," and "percent of adequate responses to the top five diagnoses." When queried, he was not familiar with either the ICMA or the IAFF/IAFC performance measures for EMS. He did cite the National Highway Transportation Safety Administration (NHTSA) as a possible source of a standardized set of EMS performance measures. He cited intubation and IV success rates as possible quality measures for EMS, but was unaware of any national data that could be used to set targets or benchmarks (Daniels, 2004).

Becker, Smith, & Rhodes (1993) and Siscovick (1993) find that survival rate from cardiac arrest may not be a valid performance indicator for cross-system comparison. Becker et al. note that survival rates in different EMS systems vary widely—from 2% to 33%. Siscovick (1993) finds similar variances. Although many have traditionally attributed this variation in survival rates to the relative quality of the various EMS systems, Becker et al. find that survival rates are strongly influenced by the incidence of cardiac arrest in the community served. The incidence of cardiac arrest in a community

is significant because it serves as a hidden marker for variations in risk caused by factors such as race, socioeconomic status, diet, smoking, and behavior. These co-factors to morbidity and mortality reveal that some populations are sicker than others, and thus less likely to survive cardiac arrest. They propose that true inter-system comparisons must control for the variable of cardiac arrest incidence. Becker et al. propose an alternative measure: reported survival rate vs. expected survival rate. Siscovick notes that data collection on cardiac arrest cases must include patients who do not present to the EMS system, in order to reduce potential bias in comparisons of cardiac arrest survival rates between different communities.

The IAFF/IAFC *EMS System Performance Measure Instrument* (2002) offers a promising set of EMS quality performance measures, including:

- What percentage of patients encountered [improved/had no change/got worse or died] following care by EMS personnel?
- What percentage of calls that needed defibrillation had first shock delivered within 5 minutes from the time of collapse?
- What percentage of ALS calls did the paramedic(s) follow appropriate recognized protocol?

Summary

The literature review raised many questions about the validity of the eight-minute ALS response time standard as a clinical performance indicator for EMS (Bailey & Sweeney, 2003; Johnson, 1991; Lerner et al., 2002; Pepe, 1993, 1998; Pons & Markovchik, 2002). The literature does, however, suggest that the eight-minute response

time standard is a valid operational process performance indicator (Moore, 2004; Overton, 2004; Overton & Stout, 2002). The literature review and informational interviews reveal that the DC Fire/EMS Department's current use of the eight-minute response time standard is broadly consistent with industry best practice, however the Department is currently failing to measure its response time performance by geographical sub-area, a key component of system evaluation according to Stout & Overton (2002).

While the review suggests that the Department's calculation and reporting of response time is consistent with industry best practice, benchmarking against other jurisdictions proved challenging, due to the lack of comparative performance data. Despite attempts to establish standardized definitions and reporting structures for response time, wide variation in usage persists, and few jurisdictions are contributing to national performance databases.

The literature review revealed that the DC Fire/EMS Department's performance measurement system, while structurally consistent with best practices in municipal management, fails to capture at least two of the five expected benefit areas outlined by Moore (2002). This suggested that the Department's current set of performance measures for EMS is incomplete, which influenced the author to expand his survey of alternative EMS performance measures.

The literature review discovered that there are many EMS quality performance indicators beyond response time. This influenced the recommendation that the DC Fire/EMS develop a more comprehensive instrument for measurement of EMS system performance. The author has begun collecting and collating potential alternative performance measures for further research and evaluation.

PROCEDURES

This applied research project was conducted using the National Fire Academy's suggested guidelines for historical research, which state that the purpose of historical research is to analyze the past in order to explain present events and anticipate future situations. Because the project analyzed an issue related to fire service delivery of emergency medical service in the District of Columbia, the time span was necessarily limited: from 1957, when the DC Fire Department first assumed oversight of ambulance service in the District, to the present (2004).

The author first attempted to collect as many written documents as possible that were related to the problem. For the portion of the literature review related to medical research on cardiac care and EMS response times, this task was time consuming but relatively straightforward. Peer-reviewed medical research on the relevant topics is extensive but well-indexed. Use was made of the libraries of the university consortium of the District of Columbia, particularly the medical school library at the George Washington University, to perform this search. In order to ensure completeness, the author cross-referenced his own search results against the reference lists of major meta-analyses on the relevant topics.

The literature on fire service performance measurement was somewhat more difficult to search. The fire service still lacks peer-reviewed journals, and most fire service research is published in specialized industry periodicals that are not held or indexed in many university collections. For this topic search, the online catalog of the National Fire Academy's Learning Resource Center (LRC) proved invaluable. Several

site visits were made to the Learning Resource Center over the course of this research project in order to review, transcribe, and synthesize the articles found through this search.

In addition to the LRC catalog search of books and periodicals, the author attempted to perform a meta-analysis of Executive Fire Officer Program applied research projects (ARP) that contained the following keywords in the title or abstract: “response time,” “performance measures,” “performance management,” and “benchmarking.” While this effort successfully located more than a half-dozen ARPs that were relevant to the author’s research, this attempted meta-analysis should be viewed with caution, as it contains several limitations. The LRC applies certain criteria (grade & year of publication) when selecting ARPs for inclusion in the permanent collection, thus the population sampled may not be representative of all EFOP research on the topic. In addition, it is unlikely that an EFO researcher would choose one of the keyword areas as a research topic unless it represented a challenge for their particular organization; therefore the sample is subject to selection bias.

Another limitation to the literature review was the author’s inability to perform an original survey on the use of response time as a performance measure in comparable jurisdictions. This task exceeded the resources available to the author at the time of the project, and thus was moved outside the scope of work. This is a potential action item for future research.

The literature on performance measurement in the public sector was surprisingly difficult to retrieve. Although certain contemporary texts are fairly accessible, the seminal early texts published by the Urban Institute and others are long out-of-print and

also scarce in university collections. The author was fortunate to obtain the loan of several rare articles and textbooks on this topic from the personal libraries of Doug Smith, director of strategic planning and performance management for the District of Columbia, and Thomas P. Hoey, a performance analyst at the DC Department of Corrections and founding member of the District's productivity management review team.

Perhaps the most difficult search for source material was the effort to locate and retrieve internal Fire/EMS Department historical documents related to the topic areas. The DC Fire/EMS Department lacks a formal historical archive or organized record retrieval system. In addition, institutional memory on management decisions made during the sixties and seventies is poor, as the key participants have long since retired. The author was granted access to the collected files of the Office of the Fire Chief and the Office of the Deputy Mayor for Public Safety and Justice, and was given permission to use selected source documents located there. This search for relevant historical records spanned several months, as much of the material was simply stored in bulk rather than filed by topic. An ancillary benefit to this literature search was that the author was able to organize and file a large quantity of DC Fire/EMS Department historical information for use by future researchers.

In addition to the standard card catalog searches, the author performed keyword searches on the topic areas utilizing Google © and several other Internet search engines. This technique was particularly helpful in retrieving performance reports and strategic plans from fire service agencies, as well as online results from several national EMS surveys. These documents were supplemented with material from the author's extensive

personal collection of fire/EMS service strategic plans and performance reports, compiled as potential benchmarking material while the author was serving in the strategic planning function within his department.

Another useful source of literature and comparative performance data was the Center for Performance Measurement at the International City/County Management Association (ICMA), which the author accessed through subscription.

The author supplemented the literature review with interviews performed with primary sources who had the potential to add historical insight on the research topic. An attempt was made to locate stakeholders with both subject-matter expertise and diverse backgrounds and perspectives. Given the political implications of this research, the author was particularly determined to interview sources who could represent the potentially diverse viewpoints of the following stakeholder communities: medical, academic, public administration, labor union, management, fire-based EMS, public-utility model or privatized EMS, and third-service EMS.

The author was fortunate to be able to speak with persons from each of these communities during the course of his research, and four of these interviews are quoted directly in this applied research project:

- Dr. Fernando Daniels III, Medical Director, DC Fire/EMS Department. Interview conducted in person at his office, DC Fire and EMS Department Headquarters, 1923 Vermont Ave., NW, Washington, DC, on 7/29/04.
- Mr. Thomas P. Hoey, Senior Analyst, DC Department of Corrections. Interview conducted in person at his office, DC Department of Corrections Headquarters, 1923 Vermont Ave., NW, Washington, DC, on 7/29/04.

- Dr. Lori Lynn Moore, Assistant to the General President, International Association of Firefighters (IAFF): Interview conducted in person at her office, International Association of Fire Fighters Headquarters, New York Ave., NW, Washington, DC, on 7/26/04.
- Mr. Jerry Overton, Executive Director, Richmond Ambulance Authority, and President, American Ambulance Association. Interview conducted in person at his office, Richmond Ambulance Authority Headquarters, Richmond, VA, on 7/27/04.

Although the input of these subject matter experts is certainly informed by their professional positions and experiences, it is important to note that the comments quoted in this research project represent the personal opinions of the interviewees, and not necessarily those of their employers.

Each of these interview subjects brought a unique perspective to analysis of the research problem. Dr. Fernando Daniels III, as medical director of the DC Fire/EMS Department was well qualified to comment on public health and systemic medical issues in the District of Columbia. Dr. Lori Lynn Moore has performed ground-breaking research on EMS performance measurement as part of her doctorate in public health. In her professional role as assistant to the general president of the International Association of Fire Fighters, she is an articulate advocate for fire-based EMS systems. Mr. Jerry Overton is a widely published and well-respected author and EMS system design expert. As executive director of the Richmond Ambulance Authority and current president of the American Ambulance Association, he has been an articulate advocate for the public utility model of EMS for several decades.

Finally, one of the most interesting and productive interview experiences in this project took place with Mr. Thomas P. Hoey, a veteran performance analyst with the District of Columbia Government. Current practitioners of strategic planning and performance management in the District of Columbia government (the author included) have held the belief that the use of performance measurement as management tool was introduced to the District during the reform administration of Mayor Anthony A. Williams in 1999. The author's interview with Mr. Hoey, who entered District government as a performance analyst in 1973, revealed that the modern concept of performance measurement has a long and rich history in the city, dating back to the 1960s. Mr. Hoey shared generously of his institutional memory and personal archives, and greatly added to the depth and quality of the literature review of this applied research project. This interview helped uncover three decades of history that had been lost or hidden from current practitioners of performance management in the District, and will add significantly to the body of knowledge in this area.

Finally, the author attempted to sort the historical data into chronological order by topic area, in order to enhance clarity and utility. It is hoped that the collection, organization, analysis and synthesis of this data will enhance the understanding of the history of EMS response time as a critical issue in the DC Fire/EMS Department, as well as provide useful information for future decision-making.

RESULTS

This applied research project attempted to answer the following research questions:

1) **What is the origin of the 8:00 minute ALS response time standard?**

The eight-minute standard for advanced life support (ALS) response time evolved out of the pioneering research of Dr. Mickey Eisenberg, Dr. Leonard Cobb, Dr. Michael Copass, and others, who established a clinical correlation between early defibrillation and survival from out-of-hospital cardiac arrest. The clinical body of knowledge on this topic was eventually extrapolated into the assumption that the likelihood of survival from out-of-hospital cardiac arrest declined dramatically if CPR was not initiated within four minutes of arrest and advanced life support care (defibrillation and Advanced Cardiac Life Support) within eight minutes.

These findings were adopted by the American Heart Association (AHA) and incorporated into the ACLS guidelines for emergency resuscitation. In turn, the ACLS guidelines informed the development of the EMS response time targets contained in NFPA 1710: Standard for the Organization and Deployment of Fire Suppression Operations, Emergency Medical Services Operations, and Special Operations to the Public by Career Fire Departments, first defined as eight minutes, fifty nine seconds or less, then later as eight minutes or less. These findings also informed the development of similar EMS performance standards by the Commission on the Accreditation of Ambulance Services (CAAS) and the International Association of Fire Fighters & International Association of Fire Chiefs (IAFF/IAFC Joint Project).

2) How did the DC Fire/EMS Department come to adopt the 8:00 minute standard?

The eight-minute response ALS response time standard, expressed as a fractile statistic, was introduced to the District of Columbia Fire/EMS Department as a “best practice” in 1987 by Productivity Management Services (PMS), an internal management

consulting group housed in the Office of the City Administrator. Between 1987 and 1995, PMS performed nine separate projects involving EMS, in response to recurring concerns that an "ambulance crisis" existed in the District. PMS was aided in this effort by private EMS consultant Jack Stout, pioneer of the system status management concept and early adopter of fractile reporting of response times.

The use of fractile reporting was reinforced in 1997 by external consultants Deloitte & Touche and Tri-Data Corporation. These consultants were part of a top-to-bottom review of District government services that had been ordered by the District of Columbia Financial Responsibility and Management Assistance Authority in response to the District government's fiscal crisis.

The use of the eight-minute response time standard was further reinforced in 2001 by the EMS Response Time Committee, an internal Fire/EMS Department working group charged with providing solutions to help the Department meet its EMS response time targets. This committee developed a detailed data dictionary defining the different elements comprising response time interval calculations in the District. The committee also attempted to provide a refined definition of response time that would aid the Fire/EMS Department in benchmarking their response time performance against that of other jurisdictions.

The DC Fire/EMS Department currently utilizes the eight-minute response time standard as the key strategic result goal for EMS, and is held accountable for performance through the use of management scorecards, performance contracts, and monthly and annual performance reports. The Department calculates its ALS response time statistic as: the percent of all critical medical calls for service (Charlie and Delta

dispatches under the Medical Priority Dispatch System) with ALS resources arriving on the scene within eight minutes or less, measured as dispatch-to-scene. Note: ALS resources can be deployed from a variety of platforms, including fire engines, EMS transport units, and utility vehicles ("chase cars"). Table 2 illustrates a typical monthly performance report entry for the response time performance measure, with internal commentary addressing performance issues and other action items.

Table 2: Response time as reported in the FEMS agency monthly performance report[1]

Performance measure 1.1: "Percent of critical medical calls for Advanced Life Support (ALS) service responded to within 8 minutes, measured as dispatch-to-scene."

	FY 2002	FY 2003	**June 2004**	FY 2004 YTD	FY 2004 (Year-end)	FY 2005
Target	80%	90%	**90%**	90%	90%	90%
Actual	74.4%	70.8%	**77.4%**	70.8%		

Note: Agency Scorecard Goal 1.

Agency Commentary for 06/04: After significant drops in ALS response times were noted in May 2004, Chief Thompson immediately formed a task force to analyze the problem and implement solutions. Meeting weekly in his office, the task force has identified several key issues that impact the Department's recent response time performance. The work of the task force is ongoing, but their efforts appear to be bearing fruit. **The Department's ALS response time statistic of 77.4% this month is the best performance recorded during the past two fiscal years**, and is comparable to the peak performance the Department achieved in the fall of 2002 when all six Paramedic Engine Companies were in service. Much of this performance improvement can be traced to the Department taking more aggressive efforts over the past six weeks to track the location and status of EMS transport units and improve compliance with basic performance expectations. Another possible driver of the performance improvement is the implementation of Special Order 32: "Initiative for Improved EMS Service Delivery," which took effect on May 30, 2004. This order is designed to address many of the underlying issues that impact accountability and performance for EMS units.

As part of the broader analysis of recent fluctuations in response time performance, the following issues have come to light:

- **Poor compliance with on-scene reporting requirements causes the ALS response time performance to be artificially low.** This means that the Department's actual performance is actually better than the data would suggest, probably by several percentage points. This is primarily due to many EMS transport units failing to mark their arrival promptly when they arrive on the scene, which causes their dispatch-to-scene time to be artificially long. It is unclear what the root cause of this performance problem is, but the Department is developing strategies to address the situation. These strategies

include training on use of the DEK system, new labels for all DEK buttons, more aggressive monitoring of units from the PSCC using the Automatic Vehicle Locator feature, and holding EMS supervisors strictly accountable for the performance of units under their supervision. As part of this drive for greater accountability, the performance plans of the EMS supervisors have been modified to include criteria related to response time and DEK compliance.

- The task of scrubbing the response time data to eliminate or correct the bad arrival information is extremely labor-intensive and requires technical expertise. Two different databases (CAD and AVL/Tracker) have to be cross-referenced, and this is very time-consuming. **The agency does not currently have adequate resources to thoroughly scrub the response time data, meaning that in the short-term, under-reporting will continue.** The long-term solution to this problem is to implement a technical fix that will allow us to use the AVL data to mark a unit on-scene automatically, when it reaches the proper geographic coordinates. This will reduce the human error factor. The director of the PSCC is currently researching the requirements for this solution.
- Paramedic unit availability decreased during March—May, driven largely by increased absenteeism and large numbers of members being detailed to training or re-certification classes. This would suggest that **at least part of the decrease recorded in April and May was driven by paramedic units being downgraded to basic status or placed out-of-service due to manpower**, meaning that ALS units are dispatched from longer distances and have longer response times. This adds urgency to the Department's ongoing efforts to implement one-plus-one staffing, increasing unit availability and ending the downgrading of fully-equipped ALS units to BLS status. This also suggests the Department needs to do a better job of managing training and re-certification schedules so that it avoids cyclical surges. The Department also needs to manage civilian EMS absenteeism more effectively, which is a key administrative reform component of Special Order 32 (May 14, 2004): "Initiative for Improved EMS Service Delivery."
- Because the performance problem coincided with the switchover to the new CAD system, the agency explored the possibility that there was a technical or mechanical explanation for the April-May performance drop. **After thorough review, we have provisionally ruled out technical problems as being the cause of this statistic. This appears to be a performance problem, not a technical one.**

[1] Table and associated text by author. Reprinted from June 2004 FEMS agency monthly performance report

3) Are other jurisdictions using the eight-minute standard?

Other jurisdictions are using the eight-minute response time standard, however wide variance exists in methodology and reporting style. The literature review was unable to determine how many jurisdictions are using the eight-minute standard, nor was it able to identify what percentage have complied with a standardized definition or reporting style.

The author was able to locate only one contemporary national survey that explicitly addressed response time standards: the *1st National EMS Systems Survey*,

published in 2003 in Emergency Medical Services Magazine. Of the systems surveyed, 37% started the response time clock during some phase of the call-taking process, 45% started the response time clock at time of dispatch, and 4% started the response time clock at the conclusion of turnout ("wheels rolling"). Of the systems surveyed, 86% stopped the response time clock at time of arrival on scene, while 7% reported stopping the response time clock when the responder reaches the patient. Of the systems surveyed, fewer than 3% reported using fractile statistics to calculate or report response times. The survey did not address what percentage of the responding agencies were utilizing the eight-minute target time for EMS. It is unknown what the selection criteria was for this survey, or if the survey population constitutes a representative sample.

A FY 2001 data set containing performance data from 77 jurisdictions that participate in the International City/County Management Association's Center for Performance Measurement did not query agencies on their use of fractile EMS response statistics or the eight-minute ALS performance target.

The 2002 Market Study*: High Performance and EMS,* published by the North American Association of Public Utility Models, reveals that all sixteen reporting agencies calculate and report response time against the 90th percentile using fractile statistics, however variance exists in the definition of the eight-minute target, with a reported range between 7 minutes, 59 seconds to 8 minutes, 59 seconds, dependent on the system.

Anecdotal evidence (agency strategic plans and performance reports) gathered by the author during the course of this research suggest that the eight-minute standard (or variations thereof) is used by many jurisdictions that practice "managing for results"

systems, such as Seattle, WA; San Antonio, TX; Austin, TX; Maricopa County, AZ; and Washington, DC.

A review of published performance reports from the dozen jurisdictions comprising the National Capital Region (surrounding Washington, DC) revealed that at least two (Montgomery County, MD & Prince William County, VA) have adopted fractile response time targets that establish variable performance criteria for less densely populated sections of their service area. Montgomery County, for instance, establishes a 95% ALS target for urban areas, a 65% ALS target for suburban areas, and a 50% target for rural areas.

While the research project was able to establish that at least some jurisdictions calculate and report response time data in a manner that is comparable to the District's, it was unable to determine the size of this population. Nor was it able to determine if these jurisdictions constitute valid comparisons for benchmarking purposes. Further research will be needed in this area.

4) What other performance measures are used—locally, regionally, nationally, and internationally—to measure EMS system performance?

The author found numerous examples of EMS quality indicators exclusive of response time. Many of these measures are contained in standards or guidelines promulgated by organizations with an interest in measuring and improving quality in EMS, such as the National Highway Traffic and Safety Administration (NHTSA) National Highway Transportation Safety Administration (NHTSA), International City/County Management Association (ICMA), Commission on Fire Accreditation International (CFAI), National Fire Protection Association (NFPA), International

Association of Fire Fighters (IAFF), International Association of Fire Chiefs (IAFC), Commission for Accreditation of Ambulance Services (CAAS), American Society for Testing and Materials (ASTM), & the National Association of EMS Physicians (NAEMSP). Efforts also exist at the state and local level to develop appropriate and effective EMS quality indicators.

Of the major sets of EMS quality indicators or performance standards, only the joint IAFF/IAFC *System Performance Measurement Instrument* claims to have undergone a formal field-testing and validation process.

The international EMS community represents an under-explored resource in the search for alternative EMS quality performance indicators. While the author uncovered intriguing examples of alternative approaches to process and outcome measurement among fire/EMS departments, in the UK, New Zealand, and elsewhere, a comprehensive review of this material proved beyond the scope of time allotted to this research project. This remains an avenue worthy of future exploration.

The full collection of EMS system performance measures gathered by the author during the course of this applied research project runs into the hundreds of pages, and thus cannot be reproduced within the text of this report. The material has been collated for future evaluation by the author and others as noted in the recommendations section.

5) **What does the historical research suggest about the validity and utility of the 8:00 minute standard as a key result goal for the District of Columbia?**

A review of the literature revealed that the clinical basis for the eight-minute response time standard is the relationship between time of clinical intervention (CPR,

early defibrillation, and early ACLS) and survival from out-of-hospital cardiac arrest. No definitive evidence exists to date proving that response time is related to improved clinical outcomes for any condition other than cardiac arrest. Fewer than 400 out-of-hospital cardiac arrests occur in the District each year, comprising less than 1% of the total EMS call volume. The DC Fire/EMS Department applies the eight-minute response time standard to *all* critical medical calls, of which there are approximately 51,000 per year (36% of the total EMS call volume). Therefore the DC Fire/EMS Department currently applies a performance standard (eight minutes or less for arrival of 1st ALS resource) that has no proven relationship to outcome for the vast majority of the instances in which it is applied.

A second challenge to the validity of the eight-minute response time standard is the extent to which it accounts for delays in reaching a patient's side. The literature suggests that time to reach the patient's side is a hidden and significant component of true response time in comparable urban jurisdictions, and may negate any clinical benefit derived from rapid dispatch, turnout, and travel time.

A common definition of validity for performance indicators is: an indicator that accurately measures the concept it is intended to measure. Determining whether the eight-minute standard is a valid performance indicator depends in large part on what the user intends it to measure. If our intent is to use fractile response time *as a process measure* to evaluate our success at predicting and meeting temporal and geographic demand for pre-hospital emergency care, then the eight-minute standard is a valid measure. If our intent is to use fractile response time *as a result or outcome measure* to evaluate our success at delivering appropriate clinical resources in an efficient and

effective manner in order to improve clinical outcomes for patients experiencing critical medical emergencies, then the validity of the eight-minute standard would appear to be questionable.

More rigorous evaluation of the formal elements of validity (content validity, criterion validity, and construct validity) was beyond the scope of this applied research project, which was limited to historical research methods.

Paradoxically, while the validity of the eight-minute standard may be questionable, its utility is not. Citizens clearly have an expectation that EMS will arrive rapidly when requested, regardless of the nature of the emergency. Furthermore, thanks to years of public outreach and education by the American Heart Association and other groups (as well as high profile articles in media outlets such as USA Today) citizens have a high awareness level of the eight-minute response time standard, as well as an expectation that the EMS agencies that serve them will be able to achieve it. Until this expectation is changed, public safety agencies will need to demonstrate that they are meeting the expectations of their customers. Thus, fractile measurement and reporting of response time performance against the eight-minute target will likely remain an industry best practice for the foreseeable future, regardless of the clinical effectiveness of rapid response.

In addition, EMS agencies have a legitimate need to ensure that they are deploying their assets so as to minimize variation in response time due to fluctuations in temporal or geographic demand. The fractile measurement and reporting of response time against an established benchmark is an extremely useful tool for measurement of this process.

DISCUSSION

Performance measurement and benchmarking are widely regarded as "best practices" in municipal management. The District of Columbia has long made use of performance measurement as a management tool—with evidence dating back to the 1960s of management reports using performance measures—and this involvement continues today. The District currently utilizes "performance-based budgeting" and "managing for results" systems, and performance data is widely distributed both externally and internally in order to enhance accountability for outcomes and efficiencies.

The District of Columbia Fire/EMS Department, like all city agencies, has developed a series of series of strategic goals and key result measures (performance measures) linked to the agency budget and strategic business plan. As utilized in the District of Columbia, key results measures (performance measures) describe: "the extent to which customers experience the intended benefit as a consequence of having received the services or product delivered by the agency" (Weidner, 2003, p. 63). The key result measures for EMS are:

1.1 Percent of critical medical calls for Advanced Life support (ALS) service responded to within 8 minutes, measured as dispatch-to-scene. (Target: 90%)

2.3 Percent reduction in non-emergency medical calls. (Target: 5% reduction from previous year's baseline.)

Two additional measures indirectly affect EMS:

1.6 Percent of emergency calls processed in sixty seconds or less, call-to-queue. (FY 2004 Target: 50%)

1.7 Percent of emergency calls processed in sixty seconds or less, queue-to-dispatch. (FY 2004 Target: 75%)

The remaining 14 performance measures address fire suppression, fire prevention, risk management, fleet maintenance, training, and operational support (DC FEMS, 2004).

National best practice is to calculate and report response time as a fractile statistic, and DC Fire/EMS was an early adopter of this practice, beginning in 1987 (Hoey, 2004). The District's definition and target goal for calculating response time have varied over the years, as have those of other jurisdictions and standard setting bodies. In 2001, the District established the following definition: percent of critical medical calls for service (Charlie and Delta dispatches under MPDS) with ALS resource arrival in eight minutes or less, defined as dispatch-to-scene. This definition was consistent with that used regionally by other jurisdictions in the Metropolitan Washington region (Response Time Committee, 2001)

The District's response time measure varies slightly from that used by the largest recognized standard-setting body, the NFPA, in Standard 1710 (2001 edition) as well as that adopted by the IAFF/IAFC in their *EMS System Performance Measure Instrument* (2002). The District reports the response time interval from dispatch-to-scene, while the NFPA & IAFF/IAFC utilize the response time interval from "wheels rolling"-to-scene: a less stringent interval than the District's. While the District uses a slightly different definition for the response time interval, it is still capable of performing comparative calculations against performance data calculated using the NFPA & IAFF/IAFC criteria. The Fire/EMS Department data collection unit captures all data points associated with

response time, and can customize statistics using selected segments and intervals of the response time continuum.

The District defines the population of calls for its ALS response time measure as "critical medical calls," while the NFPA & IAFF/IAFC define the population as "emergency calls." The distinction may be moot: The District defines critical medical calls as all Charlie and Delta dispatches under its Medical Priority Dispatch System (MPDS). Alpha and Bravo calls are categorized as "non-emergency" calls, so the District may in fact be measuring the same population implied in the NFPA & IAFF/IAFC definition.

Benchmarking the District's response time performance against that of other jurisdictions remains difficult, as use of standardized data elements and fractile calculation of response time intervals remains the exception rather than the rule. In order to align its performance criteria with that of other jurisdictions, the District should seek greater involvement in the development of national EMS performance standards by groups such as NHTSA, IAFF/IAFC, and NFPA. The District should also begin contributing performance data to the ICMA's Center for Performance Measurement (of which it already is a member), as potentially useful mechanism for benchmark comparisons.

Current medical consensus is that the eight-minute ALS response time standard lacks validity as a clinical performance measure for medical emergencies other than cardiac arrest. This conforms with the view of the Fire/EMS Department medical director other internal stakeholders. (Daniels, 2004; Response Time Committee, 2001). The medical director notes that certain other conditions, such as status asthamaticus, may

benefit from rapid ALS response, although this hypothesis remains untested. This will be a promising avenue for future research.

Examples exist of other EMS quality performance indicators, such as the IAFF/IAFC's *EMS System Performance Measure Instrument.* The District should conduct a thorough evaluation of potential alternative EMS quality performance indicators, with the goal of expanding its performance measure set. Given the limitations of response time as a clinical performance indicator, the District needs to create a more comprehensive and holistic instrument for evaluating and reporting EMS system performance.

The eight-minute response time standard retains value as an operational process performance measure (Moore, 2004; Overton, 2004) and it is useful and appropriate to continue using it as such. The District needs to expand its measurement of response time to include performance by city ward and other geographic sub-areas, consistent with industry best practice, in order to ensure that all areas of the city are receiving equal coverage (Overton & Stout, 2002).

RECOMMENDATIONS

1. The District of Columbia Fire/EMS Department should continue the use of the eight-minute response time standard as an operational process measure, but it should avoid overstating its relevance as a clinical quality indicator.

2. The District of Columbia Fire/EMS Department should resume reporting its eight-minute response time performance by ward and other geographic sub-area, in order to ensure that service is equalized across all sections of the city.

3. The District of Columbia Fire/EMS Department should expand its EMS performance measures to include a more holistic set of elements, including quality of care and patient outcome.

4. The District of Columbia Fire/EMS Department should aggressively participate in efforts by the IAFF/IAFC and others to develop a standardized set of performance measures for the delivery of fire, rescue, and emergency medical services.

5. The District of Columbia Fire/EMS Department should increase its use of benchmarking, and begin contributing data to the ICMA's Center for Performance Measurement.

6. The District of Columbia Fire/EMS Department should seek to identify which subsets of critical medical patients truly need rapid clinical interventions, while continuing its efforts to develop alternate pathways to emergency transport for non-critical patients.

7. The District of Columbia Fire/EMS Department should continue to involve its regional partners in the development of standardized definitions of performance.

8. Future researchers should explore international efforts to develop EMS quality performance indicators, and incorporate their findings into national, regional, and local efforts.

9. The District of Columbia Fire/EMS Department should continue to explore whether the implied relationship between rapid response times and clinical outcomes has any validity—this will remain a research topic of vital interest to the EMS community for years to come.

Reference List

American Federation of Government Employees Local No. 3721. (2003, October 16). *Presentation of AFGE Local No. 3721 to the District of Columbia City Council.* [Oversight hearing testimony]. Washington, DC: Author.

American Heart Association. (1987). *Textbook of advanced cardiac life support, second edition*. Dallas, TX: Author.

Andrus, D.L. (2000). *Developing comparative performance measures for the Salt Lake City Fire Department*. [Applied research project submitted to the National Fire Academy Executive Fire Officer Program, January 2000].

Bailey, E.D., & Sweeney, T. (2003, March). *National Association of EMS Physicians position paper: considerations in establishing emergency medical services response time goals.* [Position paper]. Lenexa, KS: National Association of EMS Physicians.

Becker, L.B., Ostrander, M.P., Barrett, J. (1991). Outcome of CPR in a large metropolitan area—where are the survivors? *Annals of Emergency Medicine*. *Vol. 20,* 355-361.

Becker, L.B., Smith, D.W., & Rhodes, K.V. (1993). Incidence of cardiac arrest: a neglected factor in evaluating survival rates. *Annals of Emergency Medicine, January 1993, Vol. 22, 1,* 86—91.

Birnbaum, M.L. (1999). Opportunity [Editorial]. *Prehospital and Disaster Medicine, April—June 1999, Vol. 14, 2,* 5—6.

Boessaert, L.L. (1991). The complexity of comparing different EMS systems—a survey of EMS systems in Europe. *Annals of Emergency Medicine, Vol. 22, 1,* 99—102.

Bowman, B.R. (2002). *The impact of emergency medical dispatching on call processing performance measures.* [Applied research project submitted to the National Fire Academy Executive Fire Officer Program, June 2002].

Braun, O. (1993). EMS system performance: the use of cardiac arrest timelines. *Annals of Emergency Medicine, Vol. 22, 1,* 52—61.

Campbell, J.P., Gratton, M.C., & Robinson, W.A. (1991). Meaningful response time interval: is it an elusive dream? (Editorial). *Annals of Emergency Medicine, Vol. 20, 4,* 433.

Campbell, J.P., Gratton, M.C., Salamone, J.A., & Watson, W.A. (1993). Ambulance arrival to patient contact: the hidden component of prehospital response time intervals. *Annals of Emergency Medicine, Vol. 22, 8,* 18—21.

Campbell, J.P., Gratton, M.C., Salamone, J.A., Lindholm, D.J., & Watson, W.A. (1994). System implications of the ambulance arrival-to-patient contact interval on response interval compliance. *Prehospital and Disaster Medicine, October—December 1994, Vol. 9, 4,* 230—233.

Castillo, C.J. (2002). *Complying with NFPA 1710: an analysis of the Miami-Dade Fire Rescue Department's response times.* [Applied research project submitted to the National Fire Academy Executive Fire Officer Program, February 2002].

Cobb, L.A., Werner, J.A., Trobaugh, G.B. (1980). Sudden cardiac death: a decade's experience with out-of-hospital resuscitation. *Modern Concepts of Cardiovascular disease, Vol. XLIX, 6,* 31—36.

Commission on Accreditation of Ambulance Services. (1993). *Standards for the accreditation of ambulance services* (4th printing). Dallas, TX: Author.

Deloitte & Touche, LLP. (1997, June 6). *District of Columbia performance measurement study*. [Technical report produced for the District of Columbia Financial Responsibility and Management Assistance Authority]. Washington, DC: Author.

District of Columbia Fire and Emergency Medical Services Department. (2004). *Strategic business plan: 2004--2006*. [Strategic plan]. Washington, DC: Fire and Emergency Medical Services Department.

District of Columbia Fire and Emergency Medical Services Department Response Time Committee. (2001). *DC Fire/EMS response time committee report*. [Internal report]. Washington, DC: Fire and Emergency Medical Services Department.

District of Columbia Government. (2004). *FY 2005 proposed budget and financial plan, congressional submission*. Washington DC: District of Columbia Government.

Dunford, J., Domeier, R.M., Blackwell, T., Mears, G., Overton, J., Rivera-Rivera, E.J., et al. (2002). Performance measurements in emergency medical services. *Prehospital Emergency Care, Vol. 6, 1,* 92—98.

Eckstein, M. & Pratt, F.D. (2002) Fire. In National Association of EMS Physicians. *Prehospital systems and medical oversight* (3rd. Ed.). pp. 68—74. Dubuque, Iowa: Kendall/Hunt.

Eisenberg, M.S., Bergner, L., & Hallstrom, A. (1980). Out-of-hospital cardiac arrest: improved survival with paramedic services. *The Lancet, April 12, 1980,* 812—815.

Eisenberg, M.S., Horwood, B.T., Cummins R.O., Reynolds-Haertle R., Hearne T.R. (1990). Cardiac arrest and resuscitation: a tale of 29 cities. *Annals of Emergency Medicine, Vol. 19, 2, 179—186.*

Emergency Medical Services (2003). *1st national EMS systems survey*. [Survey conducted by Emergency Medical Services magazine]. Retrieved February 25, 2004 from http://www.emsmagazine.com/issues/systemsurvey2003.html

Evans, B. (2001). Shopping for standards. *Fire Chief*, September 2001, 18—19.

Few, R. (2000, October 31). *Executive summary of Fire and EMS Department strategic plan for FY 2001*. [Internal memorandum.]. Washington, DC: Fire and Emergency Medical Services Department.

Fire and Emergency Medical Services Department. (2004) *Agency strategic business plan FY2004—FY2006.* [Internal document]. Washington, DC: Author.

Forsythe, D. W. (Ed.) (2001). *Quicker, better, cheaper? Managing performance in American government.* Albany, NY: Rockefeller Institute Press.

Foulk, D., Ryan R. (1989). Getting to the heart of rural EMS. *Journal of Emergency Medical Services, 14*, 54—59.

Hatry, H. (1992). *How effective are your community services? Procedures for measuring their quality.* Washington, DC: Urban Institute/ICMA.

Hatry, H. (1996). Tracking the quality of services. In Perry, J.L. (Ed.). *Handbook of public administration* pp. 537--554. San Francisco: Jossey-Bass.

Hedges, J.R. (1993). Beyond utstein: implementation of a multisource uniform data base for prehospital cardiac arrest research. *Annals of Emergency Medicine, Vol. 22, 1,* 41—46.

Herold, R. (2000) *Benchmarking the fire service: focusing on results and improvements*. [Applied research project submitted to the National Fire Academy Executive Fire Officer Program, December 2000].

Hindle, T. (2000). *Guide to management ideas*. London: Profile.

Hogue, T. (2001). The new CAAS standards: redefining the gold standard. *Ambulance Industry Journal, Winter 2001,* 11—12.

International Association of Fire Fighters/International Association of Fire Chiefs. (2002). *EMS system performance measurement instrument: indicator profile and system measures*. Washington, DC: Author.

International City/County Management Association. (2002). *Comparative performance measurement: FY 2001 data report.* Washington, DC: ICMA.

Johnson, J.C. (1991). Prehospital care: the future of emergency medical services. *Annals of Emergency Medicine, Vol. 20, 4,* 426—430.

Kroboth III, J. (2003). *Developing and evaluating response time criteria*. [Applied research project submitted to the National Fire Academy Executive Fire Officer Program, January 2003].

Lerner, E.B., Billitier IV, A.J., Moscati, R.M., & Adolf, J.E. (2003). The time first-response fire fighters have to initiate care in a midsize city. *The Journal of Emergency Medicine, Vol. 25, 2,* 171—174.

Management Engineering and Technology Services/Office of the City Administrator. (1996, March). *Reengineering the nation's capital.* [Internal report]. Washington, DC: District of Columbia Government.

Martinez, R. (1998). New vision for the role of emergency medical services. *Annals of Emergency Medicine, Vol. 32, 5,* 594—599.

Mayer, J.D. (1979). Emergency medical service: delays, response time, and survival. *Medical Care, Vol. XVII, 8,* 818—827.

Moore, L.L. (2002). *Quality performance measures for prehospital EMS systems: instrument reliability test*. Unpublished doctoral dissertation, The George Washington University, School of Public Health and Health Services, Washington, DC.

Mould, W.E. (1999). *Unification of fire and emergency medical services*. Unpublished manuscript, submitted to the George Washington University Center for Excellence in Municipal Management.

Murray, A. (2000). New response time standards: apt and fast. *FIRE, July 2000,* 31.

Nathan, R.P. (2001). Introduction. In Forsythe, D. W. (Ed.). (2001). *Quicker, better, cheaper? Managing performance in American government.* pp. 3—16. Albany, NY: Rockefeller Institute Press.

National Association of EMS Physicians. (2002). *Prehospital systems and medical oversight* (3nd. Ed.). Dubuque, Iowa: Kendall/Hunt.

National Fire Protection Association. (2000). *NFPA 1710: standard for the organization and deployment of fire suppression operations, emergency medical services operations, and special operations to the public by career fire departments.* (2001 Ed., Draft for review.). Quincy, MA: NFPA.

National Fire Protection Association. (2000). *NFPA 1710: standard for the organization and deployment of fire suppression operations, emergency medical services operations, and special operations to the public by career fire departments.* (2001 Ed., Adopted). Quincy, MA: NFPA.

National Highway Traffic Safety Administration (1997). *Leadership guide to quality improvement for emergency medical services systems* (DTNH Contract 22-95-C-05107). [Technical manual]. Washington, DC: U.S. Department of Transportation.

Office of the Fire Chief. (1996, September). *Report to the city administrator* (September, 1996). [Internal memorandum]. Washington, DC: Fire and Emergency medical Services Department.

Office of the Fire/EMS Chief. (2004, May 14). *Initiative for improved EMS service delivery* (Special Order No. 32, Series 2004). [Departmental order]. Washington, DC: Fire and Emergency Medical Services Department.

Office of the Inspector General. (2002, October). *Report of inspection of the Fire and Emergency Medical Services Department* (Report No. 03-0001FB). Washington, DC: District of Columbia Government.

Osborne, D., & Gaebler, T. (1992). *Reinventing government*. Reading, MA: Addison-Wesley.

Overton, J. (2002). *High performance and EMS: market study 2002*. [Market study]. Richmond, VA: North American Association of Public Utility Models.

Overton, J. & Stout, J. (2002) System design. In National Association of EMS Physicians. *Prehospital systems and medical oversight* (3nd. Ed.). pp 114—131. Dubuque, Iowa: Kendall/Hunt.

Pepe, P.E. (1993). Out-of-hospital resuscitation research: rationale and strategies for controlled clinical trials. *Annals of Emergency Medicine, Vol. 22, 1,* 17—22.

Pepe, P.E. (1998). Prehospital interventions for trauma: helpful or harmful? The American point of view. *Current Opinion in Critical Care, 4,* 412—416.

Pons, P.T., & Markovchick, V.J. (2002). Eight minutes or less: does the ambulance response time guideline impact trauma patient outcome? *Journal of Emergency Medicine, Vol. 23, 1,* 43—48.

Productivity Management Services/Office of the City Administrator. (1987, June). *Preliminary evaluation of DC's emergency ambulance service.* [Internal report]. Washington, DC: District of Columbia Government.

Productivity Management Services/Office of the City Administrator. (1987, June). *Survey on emergency ambulance systems*. [Internal report]. Washington, DC: District of Columbia Government.

Productivity Management Services/Office of the City Administrator. (1988, May). *Organizational options for DC's emergency ambulance service.* [Internal report]. Washington, DC: District of Columbia Government.

Productivity Management Services/Office of the City Administrator. (1989, March). *Improving emergency ambulance operations in Washington, D.C.: a blueprint for change*. [Internal report]. Washington, DC: District of Columbia Government.

Public Technology Inc. (1977). *Improving productivity using work measurement: a management report and technical guide for state and local governments.* Washington, DC: Author.

Ray, J.R. (2000). *EMS on-scene, response time over: not yet.* [Applied research project submitted to the National Fire Academy Executive Fire Officer Program, February 2000].

Sayre, M.R., Swor, B., Pepe, P.E., & Overton, J. (2002). Current issues in cardiopulmonary resuscitation. *Prehospital Emergency Care, 7,* 24—30.

Siscovick, D.S. (1993). Challenges in cardiac arrest research: data collection to assess outcomes. *Annals of Emergency Medicine, January 1993, Vol. 22, 1,* 92—98.

Sobo, E.J., Andriese, S., Stroup, C., Morgan, D., & Kurtin, P. (2001, March). Developing indicators for emergency medical services (EMS) system evaluation and quality improvement: a statewide demonstration and planning project. *Joint Commission on Accreditation of Healthcare Organizations Journal on Quality Improvement, Vol. 27, 3,* 138—154.

Starling, G. (1998). *Managing the public sector*. Fort Worth: Harcourt Brace.

Stauber, J. (2003). *Is the NFPA 1710 standard one-minute turnout time goal for career fire departments reasonable and achievable?* [Applied research project submitted to the National Fire Academy Executive Fire Officer Program, March 2003].

Stout, J.L. (1987, September). Measuring response time performance. *Journal of Emergency Medical Services,,* 106—111.

Task Force on Quality Control of Disaster Management. (1999). Health disaster management: guidelines for evaluation and research in the Utstein style: executive summary. *Prehospital and Disaster Medicine, April—June 1999, Vol. 14, 2,* 43—52.

Thompson, A.H. (2004, June 2). *Testimony of Adrian H. Thompson, Fire/EMS Chief.* Testimony presented 6/2/04 at the Committee on the Judiciary, Council of the District of Columbia public oversight hearing on management of emergency medical services operations in the D.C. Fire and Emergency Medical Services Department, Washington, DC.

Trevino, M.H. (1996). *The identification of performance measures for application to the city of Seattle fire department.* [Applied research project submitted to the National Fire Academy Executive Fire Officer Program, March 1996].

Tri-Data Corporation. (1997). *Fire and Emergency Medical Services Department reform plan*. [Report]. Arlington, VA: Author.

Weaver, W.D., Cobb., L.A., Hallstrom, A.P., Fahrenbruch, C., Copass, M.K., Ray, R. (1986). Factors influencing survival after out-of-hospital cardiac arrest. *Journal of the American College of Cardiology, Vol. 7, No. 4, April 1986,* 752—757.

Weidner Consulting Inc. (2003). *Strategic business planning resource guide*. [Workbook]. Austin, TX: Author.

Wilbur, B.H. (1998). Introducing productivity measurements and benchmarking to a small city fire department. [Applied research project submitted to the National Fire Academy Executive Fire Officer Program, August 1998].

Woolard, M. (2003). Emergency calls not requiring an urgent ambulance response: expert consensus. *Prehospital Emergency Care, Vol. 7, 3*, 384—391.

Young, M.P. (2002). *Developing a benchmarking program for organizational success*. [Applied research project submitted to the National Fire Academy Executive Fire Officer Program, February 2002].

Zikmund, N.R. (2000). *Examination of fire department response time as it relates to life safety and property loss compared to other factors*. Unpublished manuscript, Hamline University: St. Paul, MN.

Zikmund, N.R. (2001). Response research indicates time for a change. *American Fire Journal, June 2001,* 30-32.

Appendix:

Figure 1: FY 2003 DC Fire/EMS Department ALS Response Performance, with timeline of relevant events

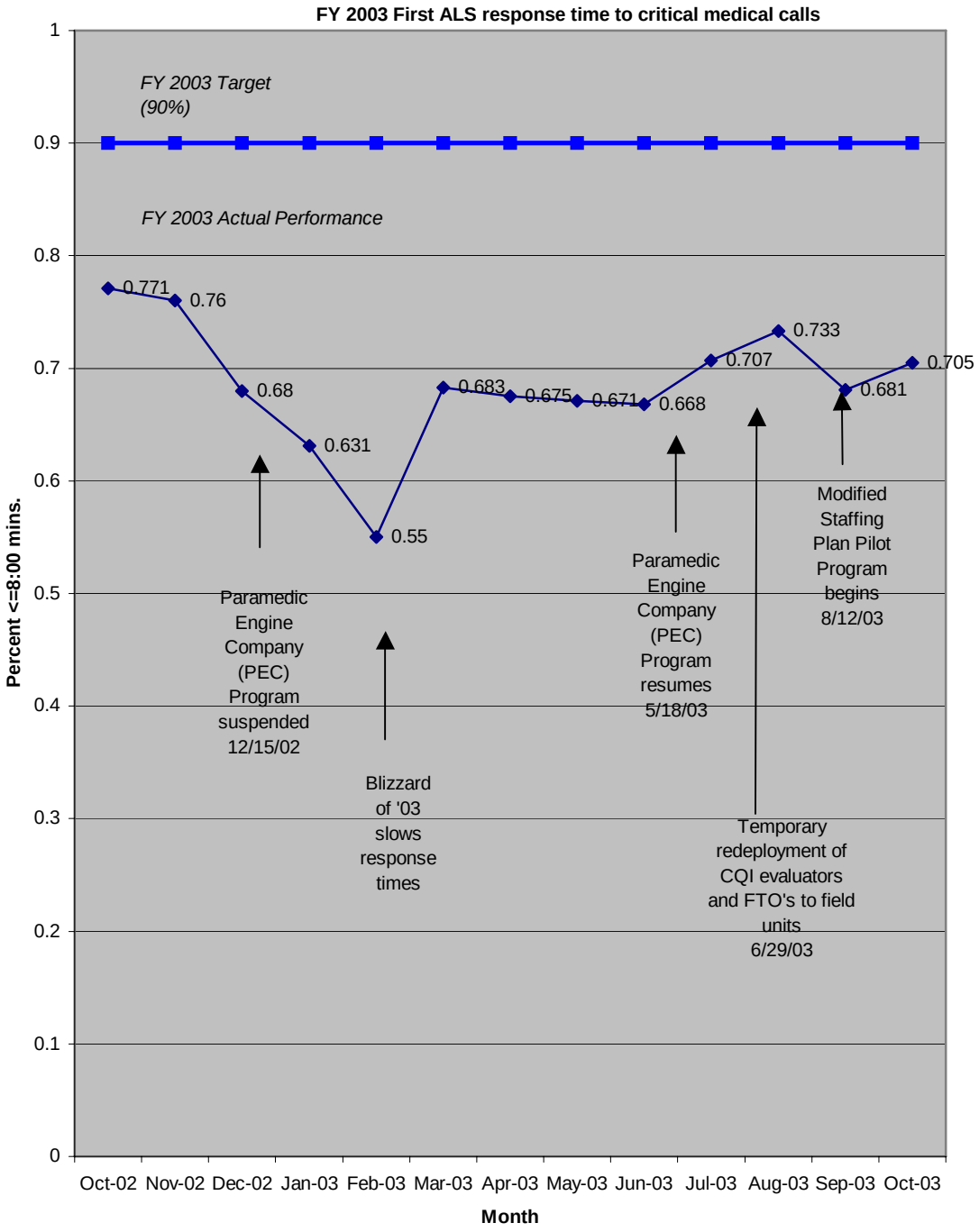

Figure by author, data source: DC FEMS FY2003 Monthly Performance Reports.

Figure 2: *FY 2003 DC Fire/EMS Department ALS Response Performance by resource type*

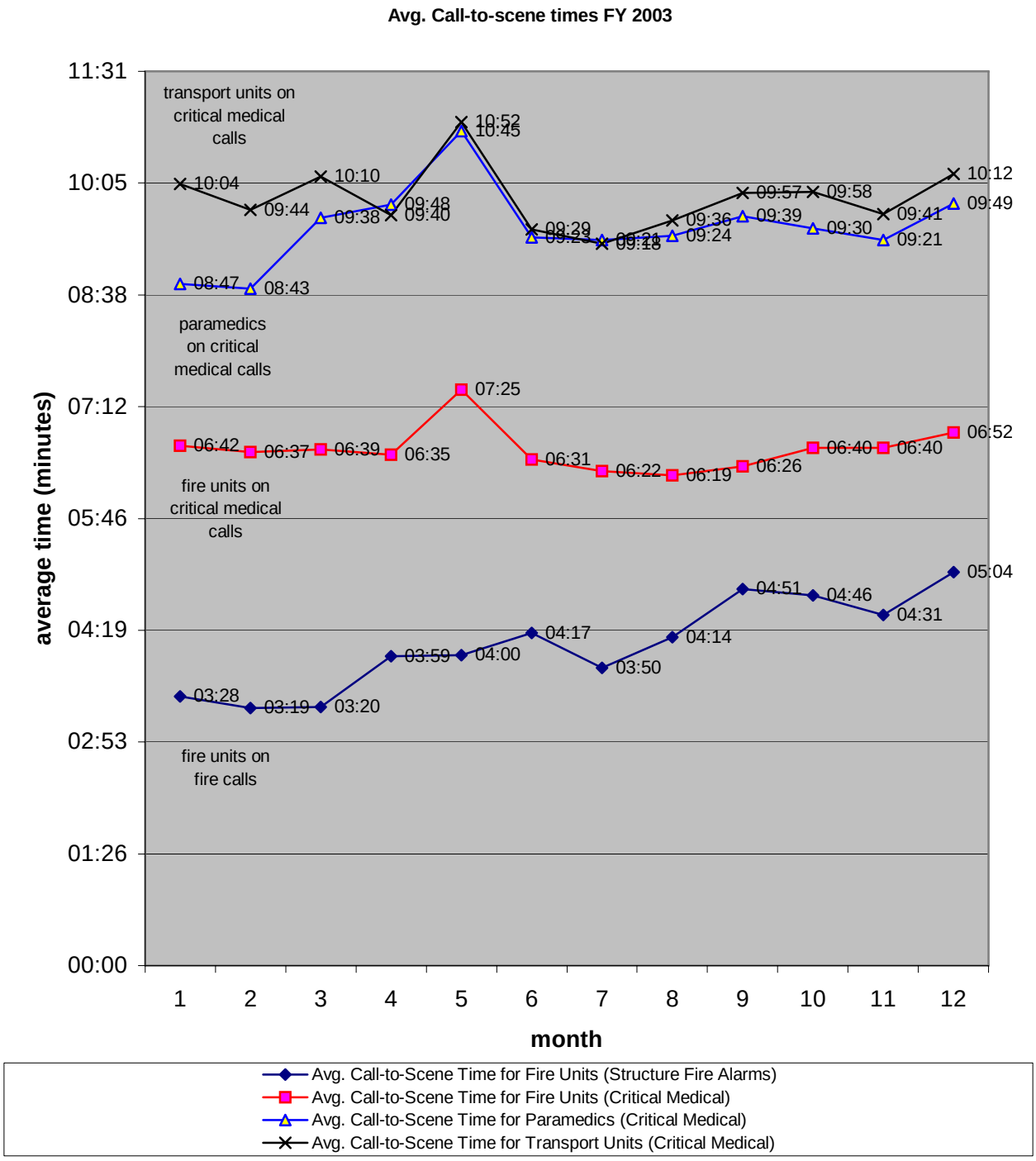

Figure by author, data source: DC FEMS FY 2003 response time statistics